Competing with Dual Innovation Strategies

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A framework to analyse the balance between operational value creation and the development of resources

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Proefschrift

Ter verkrijging van de graad van doctor aan de
Katholieke Universiteit Brabant,
op gezag van de rector magnicifus,

Prof. dr. F.A. van der Duyn Schouten,

in het openbaar te verdedigen
ten overstaan van een door het college voor promoties aangewezen
commissie in de aula van de Universiteit op
maandag 16 oktober 2000 om 16.15 uur

door

Marc André Zegveld
geboren op 27 juli 1962
te Chêne-Bougeries, Zwitserland

Promotores: Prof. dr. ir. Ph.A. Naert
Prof. dr. H.R. Commandeur

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For Toos

Foreword and Acknowledgements

This study is concerned with the observation and analysis of the behaviour of companies in terms of the exploitation of old certainties and the exploration of new possibilities. The relevance of these categories and the need for companies to balance and manage these aspects simultaneously is generally accepted within management sciences. Managers and those involved in innovation policy recognise the exploitation – exploration dilemma as relevant, each in their own domain. This study provides both a qualitative and quantitative framework to analyse the actual behaviour of a company within this dilemma. The framework is tested empirically. The purpose of this study is to improve our understanding of the development of companies, and combines the resource perspective with operational value creation.

This study was mainly inspired by intellectual curiosity. This book is also the result of almost ten years work at TVA developments, a consultancy firm specialising in developing business strategies, mainly for market makers. Working for these clients demands both unconventional thinking and a consideration of the fundamental issues. At TVA developments we embrace this type of thinking and invest heavily in research. Every quarter we organise a meeting, attended by all the professionals, on a specific management issue. These two-day meetings are prepared thoroughly by one of the consultants or partners. This study was initiated as a result of one of these quarterly meetings.

Writing a thesis is an adventure. Writing a thesis while working as a partner at TVA developments was a major challenge. I am grateful that both my clients and colleagues accepted my ambition and its effect on my availability.

This study could not have been completed successfully without the full support of prof. dr. ir. Philippe Naert (Tias Business School; Tilburg University). Besides his confidence he provided valuable suggestions on both the content of the study and the management aspect of writing a thesis. I would also like to thank prof. dr. Harry Commandeur (Universiteit Nyenrode; Universiteit Gent; Erasmus Universiteit Rotterdam) for the numerous suggestions he made and his continuous support. Prof. dr. Luc Soete (Merit; Universiteit van Maastricht) was the first person I talked with about this study and provided very worthwhile introductions and suggestions. I am also very grateful for the suggestions made by prof. dr. Hans Pennings (Wharton School; University of Pennsylvania; Tilburg University) and dr. Filip Caeldries (Tias Business School; Tilburg University).

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This study could not have been undertaken without the full assistance and commitment of Ivo Nobel of Erasmus University Rotterdam who accepted my invitation to assist me for a full year. I am also indebted to Marjo van Oekel and Ellen Pielaat for all the work that writing a thesis generates. Besides the secretarial work, Désiré van Doorne also managed my agenda which was a major challenge. In this respect I am also indebted to Coby Onverwagt of KUB-TIAS who cooperated with Désiré in synchronising different agendas.

A special word of thanks goes to Ton van Asseldonk, the founder of TVA developments, who challenged and supported me in many aspects. Ton not only accepted my ambition but also accepted the space I needed for this challenge.

I would like to express special thanks to my father Walter Zegveld who not only supported me on this study but who is responsible for the fact that we talked on innovation even before I could spell the word. Besides providing fatherly wisdom Walter is a continuous source of inspiration which I cherish very much.

Finally I would like to thank my wife Toos for her love, patience and continuous assistance. Also our son Kian needs to be mentioned; his courage exceeds the challenge of writing a thesis.

5 December 1998 – 14 July 2000
Marc A. Zegveld

1. The research problem

'*Exploit or explore?*' asks a recent ad in the Harvard Business Review (HBR, volume 77, number 5) placed by the Royal Dutch Shell Group. This is a tongue-in-cheek reference to the work of March (March, 1991, 1996) who found that companies should simultaneously exploit current certainties and explore new opportunities. The vast number of popular management books and articles on this issue bear witness to the fact that most companies find it hard to strike a balance within this dichotomy.

Many studies in management sciences recognise the exploitation – exploration dilemma. These studies, however, conclude that finding a balance is essential or confirm that the dilemma does indeed exist. There are as yet no studies that have defined the exploitation – exploration dilemma in a qualitative and quantitative framework. The creation of such a framework would provide the ability to define and measure the actual development stage or current focus of a company within the exploitation – exploration dilemma. As a result, the framework could provide information about what actually drives a company within this dilemma and an insight into aspects which provide the impetus for these developments. While exploitation focuses on alignment and refinement or incremental changes, exploration focuses on search, variation or radical changes. In this study, the punctuated equilibrium paradigm, a theory intended to detect incremental and radical change, is altered to operationalise the exploitation – exploration dilemma.

This chapter describes the research problem, along with the reasons for the research and its relevance. The introduction concludes with a number of research questions and the scientific scope of this study.

1.1 Research focus, justification and relevance

In current strategy literature it is generally agreed that strategy is about the processes and content of interactions between a company and its environment and how current and future developments may shape these interactions. With a view to survival and due to developments in the environment as well as in companies, these interactions change continually. Because of the need to adapt,

companies have to decide how to interact with their environment and how to configure internal elements to align with the chosen processes and content of these interactions. As stated by March (March, 1991) '*A central concern of studies of adaptive processes is the relation between the exploration of new possibilities and the exploitation of old certainties*'. The trade-off is about finding a balance between risk-taking, search, variation and experimenting versus refinement, selection and choice. The exploitation – exploration trade-off can be related to a broad spectrum of different perspectives on decision making. March (March, 1991) found that within a rational choice approach (Hey, 1982; Radner and Rothschild, 1975), theories of limited rationality (Cyert and March, 1963; Simon, 1955) and theories of organisational learning (Arrow, 1962; Levinthal and March, 1981; 1993; Winter, 1971) the exploitation – exploration trade-off is recognised as a fundamental issue. Also, more recent theoretical developments such as evolutionary theories (Hannan and Freeman, 1987) and systems theory (Varela, 1991) recognise the exploitation – exploration trade-off as crucial.

Recent studies which examine the dilemma (Bennet III, 1998; Garavan, 1997; Mabey and Salaman, 1995; Smith and Saint-Onge, 1996) frequently use organisation learning theories (Argyris and Schon, 1978; Fiol and Lyles, 1985; Hedberg et al, 1976) to understand the interplay between refinement, selection and choice versus risk-taking, search and variation. Learning theories are process-oriented and use time as a denominator to understand the process of adaptation. With time as a relevant dimension, learning theories do not propose an exclusive choice between exploration and exploitation but conclude that a balance should be found. In this study it is assumed that the balance between exploration and exploitation is company and time-specific.

1.2 Research scope and research questions

The choice of a strategy framework is essential to provide an understanding of the processes and the content of interactions. Learning can be best understood by using the 'resource' (Penrose, 1959) or the 'competence' view of the firm (Nooteboom, 1999a) since learning stresses the possibility of the firm to introduce new activities as a result of new information, new visions or new experiences. The chosen dynamic resource strategy framework, or resource

perspective, stresses the need to develop, innovate and learn and analyses the role of a single company in its environment, which means that the contractual theory of the firm applies (Nooteboom, 1999c; Peteraf, 1992; Pitelis, and Pseiridis, 1999; Silverman 1999; Slater, 1997). In Chapter two the punctuated equilibrium paradigm, as a framework to analyse the exploitation – exploration dilemma, will be positioned within the resource perspective which can be analysed through the use of the contractual theory of the firm.

In current research, the exploitation – exploration dilemma is frequently used as a model to show that companies should find a balance between 'first order' learning and 'second order' learning, 'single loop' and 'double loop' learning, 'short time' and 'long time' perspectives or between 'incremental' and 'radical' change. Besides studies on groups, no studies have been found which resulted in a model that could be used to analyse companies as their approach to the exploitation – exploration dilemma develops. The developed models are conceptual and case-based and hence have little empirical validation.

The punctuated equilibrium paradigm provides a conceptual framework and model to measure incremental and radical change, but does not detect exploitation or exploration. In Chapter two the relationship between exploitation and incremental change is elaborated as is the relationship between exploration and radical change. It is concluded that the current framework and related model of the punctuated equilibrium paradigm need adjustment. In order to make a distinction between the punctuated equilibrium paradigm and the adjusted model, incremental change is referred to as 'incremental innovation', and radical change is referred to as 'radical innovation'.

In Chapter two the stakeholder approach and generic firm processes are used to position the punctuated equilibrium paradigm within the resource perspective. The stakeholder approach and generic firm processes are chosen since both can be integrated within the resource perspective and stress learning.
The existence and behaviour of companies is limited by the scarcity of the different primary or core stakeholders and their relationships to the different generic firm processes. In the Western hemisphere, in particular, it is unlikely that any one of the core stakeholders will continually dominate the scarcity

ranking. To remain competitive, companies, and especially companies based in the TRIAD, need to compete on the basis of heterogeneity, differentiation or added value and thus cannot rely on copying but must bring about changes for themselves. From this perspective the process of forming resources is crucial. Based on the assumption that customers, employees, partners and shareholders all have a level of scarcity which is company and time-specific, both product and resource-heterogeneity will become the basis for competition. The different levels of scarcity of the different core stakeholders, which result in a dynamic resource heterogeneity in relation to the creation of additional resources and residual value, can be analysed by using the concept of generic firm processes. In Chapter two, the concept of generic firm processes and the stakeholder approach are related to the punctuated equilibrium paradigm.

By altering the punctuated equilibrium paradigm, a theory intended to detect incremental and radical change, the development of the trade-off between exploitation and exploration can be made visible. In Chapters three and four respectively, the conceptual models for incremental and radical innovation are presented and discussed. As a result of the developed and conceptual models eight hypotheses are defined and presented in Chapter five. To develop and validate a framework, the conceptual models presented in Chapters three and four are transformed into quantitative models, which are presented in Chapter six. Based on the hypotheses given in Chapter five and the quantitative models presented in Chapter six, the empirical study is discussed in Chapter seven. In Chapter eight this study concludes with a discussion of the results, the limitations of the proposed framework and the implications of the proposed models (Figure 1.1).

The scope of this study focuses on a single company and its relation with its environment and stresses the dynamics of resources in terms of learning and adapting. The study combines generic firm processes and the stakeholder approach to analyse aspects of exploitation such as incremental innovation and aspects of exploration such as radical innovation. In this study it is assumed that the processes and content of the interactions between companies and their environment influence the company as well as the environment. This states that interaction, and thus change itself, is continuous.

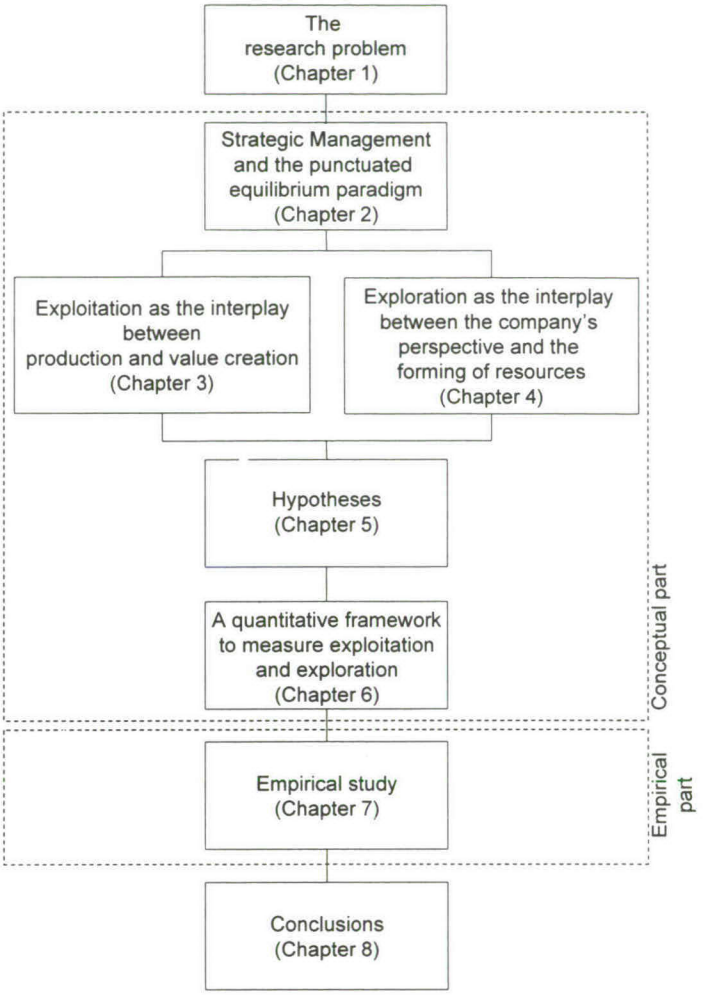


Figure 1.1: Structure of this study

As a result the following major research question arises:

1. ***Does the punctuated equilibrium framework provide a conceptual framework to analyse the actual stage of development or current focus of a company within the exploitation – exploration dilemma?***

The initial research question focuses primarily on the strategy framework that underlies the punctuated equilibrium paradigm and how incremental and radical change, as fundamental aspects of the punctuated equilibrium paradigm, can be related to exploitation and exploration.

According to the punctuated equilibrium paradigm, radical change is a high order change and can be related to exploration and is assumed to be rare (Gersick, 1991). Incremental changes may occur within the existing high order and can be related to exploitation. Based on this assumption, the processes and content of interactions between a company and its environment are not only influenced by incremental and radical innovation as aspects of changes in exploitation and exploration and the interplay of these changes. These processes and content are also influenced by the stability of both exploitation and exploration. Finding a balance between exploitation and exploration challenges aspects of stability and change (Figure 1.2).

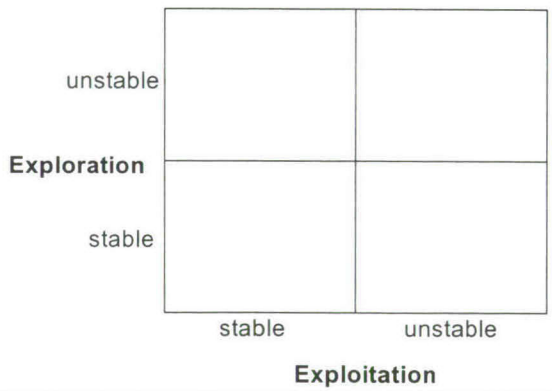


Figure 1.2: Stability and change in exploitation and exploration

The assumed relationship between incremental and radical innovation leads to a wide variety of research questions. In this study only three additional research questions are addressed, all focusing on the relation between stability and change of both exploitation and exploration. These three questions are:

2. ***Is exploration more stable than exploitation?***
   Within the existing theoretical models on change (Gersick, 1991; Romanelli and Tushman, 1994; Tushman and O'Reilly III, 1996) and

learning (Argyris and Schon, 1978; Fiol and Lyles, 1985; Hedberg et al, 1976; Helleloid and Simonin, 1994) it is assumed that exploration, with its connections with aspects of 'high order', 'double loop learning' and 'second order learning' is more stable than exploitation. Romanelli and Tushman (Romanelli and Tushman, 1994) empirically validated this assumption by analysing incremental change and radical change. However their validation covered only mutually exclusive aspects of exploitation and exploration and did not focus on stability. The research question on high order stability versus exploration stability will be tested empirically.

3. ***Does stable exploitation lead to higher levels of exploitation?***
   Stability in exploitation can be related to the deployment of a specific generic strategy over a long period, and assumes the existence of generic strategies which has been studied frequently (Dess and Davis, 1982; Galbraith and Schendel, 1983; Ghemawat, 1991; Hambrick, 1983; Karnani, 1984; Miller, 1986; White, 1986; Wright, 1984, 1987). Generic strategies are only relevant if commitment to one of these generic strategies pays off with higher levels of exploitation. This third research question will be tested empirically by linking exploitation with generic firm processes, defining generic strategies and defining an instrument to measure exploitation.

4. ***Does a change in exploration or radical innovation have an impact on the level of exploitation?***
   A high order change or radical innovation (Gersick, 1991) may influence the implicit or explicit deployment of one of the generic strategies which are related towards the scope of exploitation. It is assumed that radical innovation has a major influence on the company and therefore increases the likelihood that the company will change its generic strategy.

Further to the second research question it is assumed that a change of exploitation scope occurs more frequently than a change of exploration scope. In the third research question it is assumed that stability on the scope of exploitation leads to higher levels of exploitation. A high order change or radical innovation provides new opportunities, which may result in higher levels of exploitation. However, this may conflict with the expected

findings of the previous two research questions where it is assumed that stability in both exploitation and exploration is essential to maximise the level of exploitation.

1.3 Research contribution

In order to detect incremental and radical innovation and to reach a conclusion about stability and change, a longitudinal analysis is required. Since the company is the unit of analysis, data derived from company annual reports form the basis of the empirical validation. Conclusions based on historical data do not predict the future, but may provide additional insight into the balance between exploitation and exploration.

The scientific background of this study is management sciences. Although the origin of management sciences lies in economics, this study also makes use of several economics principles that have not yet been incorporated in management sciences. The scientific contribution of this study is related to conceptual, methodological and empirical aspects (Figure 1.3). To detect incremental and radical innovation two current methods of analysis, both with a different scientific background and purpose, have been modified. However, the heart of the conceptual framework of the exploitation – exploration dilemma, as defined by March (March, 1991), remains unchanged. Several conceptual changes, which focus on the definition and orientation of incremental and radical innovation, are suggested.

When altering existing methods of analyses, several methodological innovations are needed in order to actually detect stability in exploitation or incremental innovation and stability in exploration or radical innovation. The empirical study uses company-specific data to validate the altered framework and the proposed quantitative model. The proposed scientific contribution is to gain a deeper understanding of the relationship between exploitation and exploration (Figure 1.4). This may well result in a deeper understanding of the processes and content of the interaction of a company with its environment.

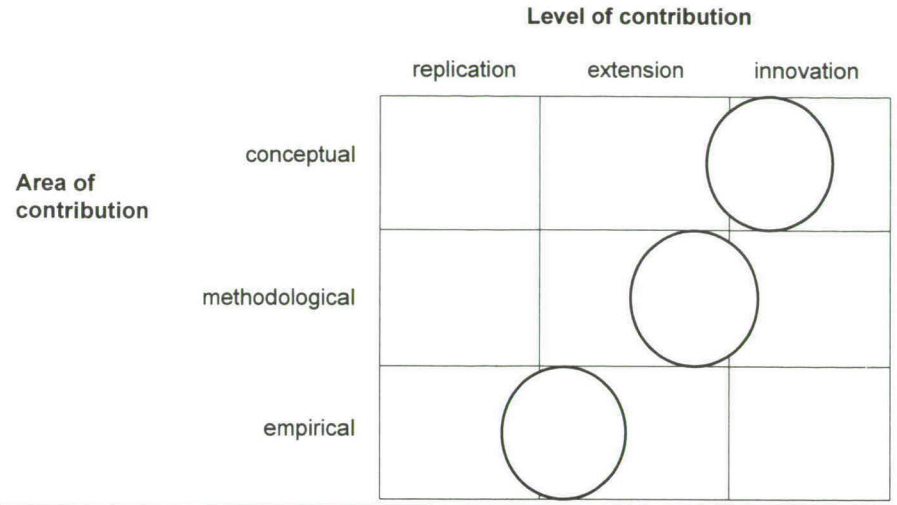


Figure 1.3: Scientific contribution

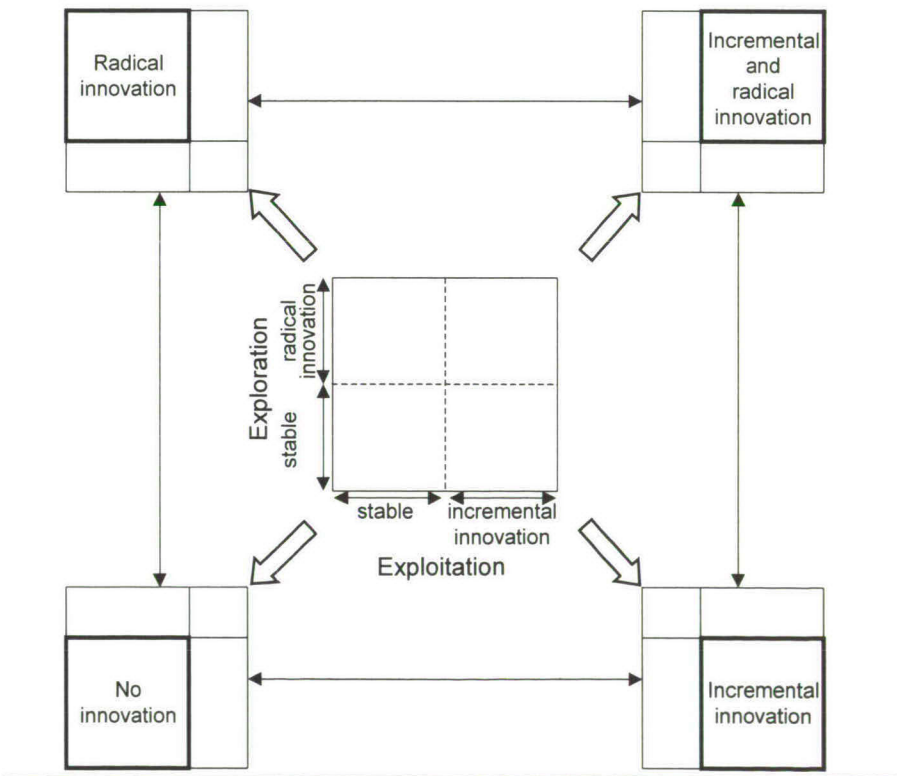
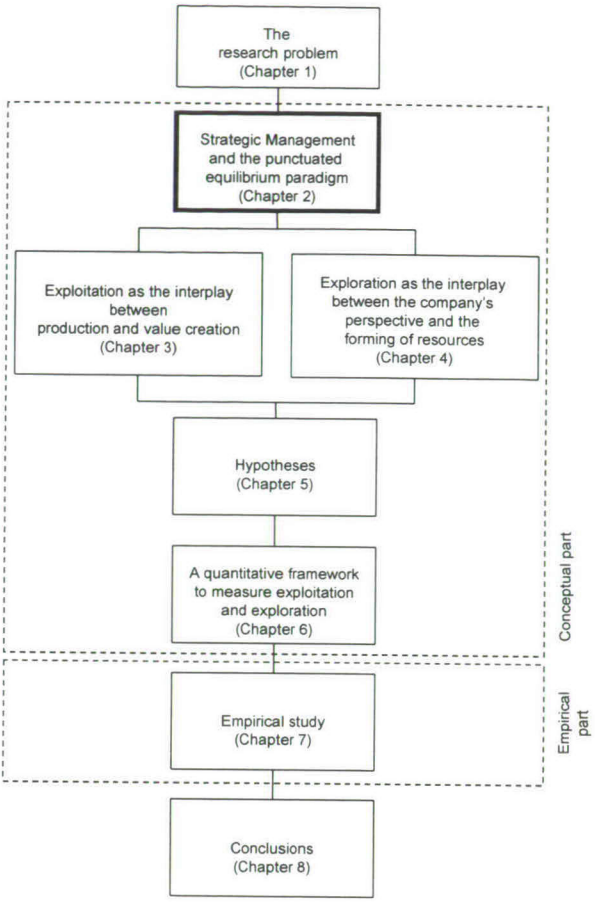
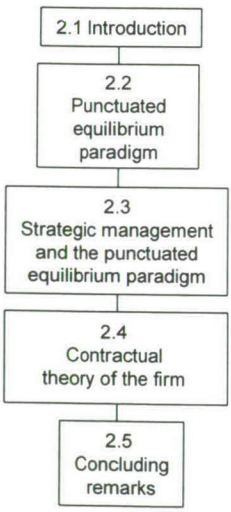


Figure 1.4: Stability and innovation spectra


The research problem (Chapter 1)
Strategic Management and the punctuated equilibrium paradigm (Chapter 2)
Exploitation as the interplay between production and value creation (Chapter 3)
Exploration as the interplay between the company's perspective and the forming of resources (Chapter 4)
Hypotheses (Chapter 5)
A quantitative framework to measure exploitation and exploration (Chapter 6)
Empirical study (Chapter 7)
Conclusions (Chapter 8)
Conceptual part
Empirical part


2.1 Introduction
2.2 Punctuated equilibrium paradigm
2.3 Strategic management and the punctuated equilibrium paradigm
2.4 Contractual theory of the firm
2.5 Concluding remarks

2. Strategic management and the punctuated equilibrium paradigm

2.1 Introduction

> *'The determination of the basic long term goals and objectives of an enterprise and the adoption of courses of action and the allocation of resources necessary for carrying out these goals.'*
> (Chandler, 1962)

To Chandler's initial definition of strategy a large number of definitions have now been added (Burgelman, 1983; Chaffee, 1985; Child, 1972; Mintzberg, 1978; Miles and Snow, 1978). What most of these definitions have in common is that strategy concerns survival and deals with changing environments (Romme, 1992). The survival of companies is based on how successfully they interact with their environment. Strategy is concerned with the processes and content of these interactions and long-term wealth as a result of these interactions (Chandler, 1962). Therefore strategy is concerned with:

- The level of health or fitness of the company, which is related to the presence and successful deployment of resources and competencies. Successful deployment implies that the company generates sufficient financial value to remain competitive.

- The existence of a vision as a long-term view of how the company should develop. A vision or long-term view has to do with the positioning of the business and understanding external developments and how these will affect the company. From a dynamic viewpoint the company also influences its environment which might affect the process of positioning as part of a complex interactive process where the company and the environment interact and influence each other.

- The environment and how developments or changes in the environment might affect the company. A company should have the ability to identify and interpret these changes and respond. Identifying, interpreting and responding are the key elements of interaction and are the fundamental aspects of adaptive systems and the process of learning.

The view of the market as a discovery procedure or a process of learning and preference formation (Hayek, 1976) stresses the epistemic capability of companies and other institutionalised agents. This capability is subjective in the sense that economic agents not only have different preferences but also have different knowledge: different minds think different things (Lachmann, 1978). Following the epistemic capability, adaptability or learning differs between companies and each company will react differently to similar stimuli, which implies that learning is path-dependent and thus company-specific (Brown and Duguid, 1991; Kim, 1994; Nooteboom, 1999b). As a result of this path-dependency companies can probably be characterised based on their company-specific learning processes, their 'logic of development' or their 'routines' (Nelson and Winter, 1982). These characteristics are the result of a configuration of technology and the related organisation or of the institutionalisation of company-specific agents. Technology, organisation and company-specific institutions are also based on the implicit or explicit vision, norms and values of the company. The vision of a company and the process of learning only make sense if there is a means to measure the rate of success related to the actual vision and the direction and speed of learning. Hence, strategic management can be defined as the interplay of adaptability and learning within the company's vision and fundamental change of the company's vision. These two aspects of strategic management form the very heart of the punctuated equilibrium paradigm (Gersick, 1991; Romanelli & Tushman, 1994; Tushman and O'Reilly III, 1996).

The punctuated equilibrium paradigm is based on a number of social and physical science disciplines, including biology (Gould, 1989), sociology (Kuhn, 1970) and psychology (Levinson, 1986). Additional support was found in the findings of Prigogine and Stengers (Prigogine and Stengers, 1984) concerning system analysis or Grand Theory. Following this theory, it is only possible to understand radical change in full detail if the periods and backgrounds of relative stability can also be understood. Research by Gersick (Gersick, 1988; 1989) on groups and by Miller and Friessen (Miller and Friessen, 1980; 1984) and by Tushman and Romanelli (Tushman and Romanelli, 1985) on organisations, show that groups and organisations are not static during periods of relative stability but change incrementally within the boundaries of an equilibrium. This equilibrium is based around the pattern of

activities defined by decisions that are institutionalised within the groups or organisation. Institutionalisation results in stability within the organisation or group (Boeker, 1989; Eisenhardt and Schoonhoven, 1990; Selznick, 1949; Stinchcombe, 1965) and inertia (Hannan and Freeman, 1984) within the environment. Within management sciences besides March, Abell (Abell, 1993; 1999; van Londen, 1993) and Rosotti (Rosotti, 1968) elaborated in a more applied way on the existence of dual strategies which Abell (Abell, 1999) defined as '*competing today while preparing for tomorrow*'.

Incremental change is continuous but is unable to change all the complex institutionalised relations between a company and its customers, employees, shareholders and suppliers. Due to the existence of stable institutionalised relations, radical change is necessary to create new activities based on the new role of the company and its relationship with the environment. According to the punctuated equilibrium paradigm the essential difference between incremental and radical change is that incremental change is about aligning, while radical change is about defining a new perspective. The punctuated equilibrium paradigm is about adaptation on two levels, i.e. within the company's vision and the process of forming a new vision. The central concern of studies of adaptive processes is the relationship between the exploration of new opportunities and the exploitation of old certainties (Schumpeter, 1934; Holland, 1975). Incremental change is related to exploitation and linked to implementation and execution, and radical change is related to exploration, risk-taking, experimentation and discovery (Holland, 1975; March, 1991). Apart from the distinction between exploitation and exploration, which is one of the distinctions made in theories of corporate change, other distinctions include first-order versus second-order learning (Fiol and Lyles, 1985; Hedberg et al, 1976) and single-loop versus double-loop learning (Argyris and Schon, 1978). Both of these different learning theories can be related to incremental and radical change which make it possible to place the punctuated equilibrium theory in the framework of corporate change; incremental change is about *'doing things better'* and radical change is about *'doing better things'*. According to Nooteboom (Nooteboom, 1999b) the distinction can also be related to theories of industrial change where a distinction is made between the creation of novel 'techno-economic paradigms' and the movement along these 'technical trajectories' based on such paradigms (Dosi, 1984; Dosi et al, 1988;

Freeman and Perez, 1989). Although this last distinction is at industry level, it has a direct impact on the behaviour and performance of companies. Following the innovation literature the creation of novel 'techno-economic paradigms' can be induced exogenously, which implies Schumperian creative destruction, or by companies active within the industry and implies creative accumulation.

In this chapter the concept of the punctuated equilibrium paradigm is analysed further and will be related to the findings of other sciences using the concept of combining incremental and radical change. To place the punctuated equilibrium paradigm in the field of strategic management, which is dominated by the industry and the resource perspective (see annex B), generic firm processes, the stakeholder approach and the contractual theory of the firm will be used. The resource perspective of the firm is chosen since both the punctuated equilibrium paradigm and resource-based strategic management share the fundamental aspect of learning. The central concern of the punctuated equilibrium paradigm is the relationship between the exploration of opportunities and the exploitation of old certainties. In order to find the current trade-off between exploitation and exploration, incremental change and radical change must be defined more precisely and non-exclusively and must be made measurable at company level.

2.2 Punctuated equilibrium paradigm

Based on studies by Kuhn (Kuhn, 1970) on the distinction between normal science and scientific revolution, the studies by Abernathy and Utterback (Abernathy and Utterback, 1982) on the contrast between evolutionary and revolutionary innovation in industry and the studies by Miller and Friessen (Miller and Friessen, 1984) on momentum and revolution in organisational adaptation, a theoretical framework emerges that focuses on change and adaptation. The similarity in the above studies is the fact that gradualism is challenged. According to Gersick (Gersick, 1991) this framework can be expanded by incorporating the work of Prigogine on order, chaos and change in '*self-organising systems*'. According to Prigogine '*the path along which a system evolves ... is characterised by a succession of stable regions, where deterministic laws dominate, and of unstable ones, near the bifurcation points, where the system can 'choose' between or among more than one possible*

future' (Prigogine and Stengers, 1984). These studies concluded that relatively long periods of stability are punctuated by relatively short periods of revolutionary change. In each of the models discussed above, the interrelationship between these two modes is explained through the existence of an underlying highly durable order. It is this type of order that persists and limits change during equilibrium periods and which disassembles, reconfigures and enforces transformation during revolutionary periods (Gersick, 1991).

The punctuated equilibrium paradigm concentrates on identifying the highly durable order, here defined as highly hierarchical order or 'high order' which lies at the heart of periods of relative stability, to provide a deeper understanding of the processes that force revolutionary change. According to Gersick (Gersick, 1991), high order is a set of coherent interdependent implicit and explicit choices which form the basic configuration into which a system is organised. Tushman & Romanelli (Tushman and Romanelli, 1985) describe high order using five facets: the core beliefs and values of the company, its employees and environment (1), products, markets, technology and competitive timing (2), the distribution of power (3), the organisation's structure (4) and the nature and persuasiveness of the existing control systems (5). In physics, high order is defined as highly stable, while choices within the system rule out many options but at the same time high order includes mutually contingent options (Prigogine and Stengers, 1984). This characterisation is similar to the findings on organisational research that initial choices can have the deepest impact (Eisenhardt and Schoonhoven, 1990; Gersick, 1988; Ginnett, 1987; Stichcombe, 1965).

The existence of high order is essential to stabilise and optimise the company on the one hand but may imply organisational inertia on the other. According to Gersick (Gersick, 1988), high order is based on a framework that forms a stable platform from which a company operates. This framework may be partly explicit but is primarily implicit and is based on interaction patterns, assumptions about group tasks (Baaij and Commandeur, 1997) and outside context. Applied to companies this would mean that high order is based on assumptions on how a company relates to its environment and assumptions about the environment itself, as well as the interaction patterns within a company based on these assumptions. By means of aggregation it is expected

that high order similarities can be found between companies. As a result of the suggested aggregation the infinite variety of company-specific choices and solutions may be lost and is only expected to provide a generic overview.

High order implies stability but does not mean accepting that the environment and the company are static (Romanelli and Tushman, 1986). Within periods of high order the company is active in maintaining and carrying out choices based on high order. This process can be defined as all types of activities, such as production and marketing, to achieve the goals implicitly or explicitly defined within the high order of the firm. The defined goals can be diverse and qualitative, such as an image or service level, or quantitative, such as market share or profits. Within the scope of high order, adjustments may be made such as reorganisations and the development of new products and services. If these adjustments are within the scope of the existing high order, they are defined as incremental change (Gersick, 1991). High order is found to be essential to structure and optimise the company but, as a result of focusing too much on the company's assumptions rather than the everyday reality, may result in organisational inertia. According to Tushman and Romanelli (Tushman and Romanelli, 1985), high order shapes the awareness and interpretation of reality, which induces specific company actions.

Kuhn also found that limited awareness of the alternatives may constrain a change in behaviour and states that phenomena '*that will not fit the box are often not seen at all*' (Kuhn, 1970). Tushman and Romanelli (Tushman and Romanelli, 1985) found that even if a company realises it must change by overcoming its own cognitive and motivational barriers, the existing institutionalised groups of interdependent relationships often prevent it from being able to change. The resistance to change can often be related to the fact that some of the institutionalised groups of a company are unaware of their new goals, work and rewards system and therefore remain active in pursuing their original goals. Based on a literature study by Tushman and Romanelli (Tushman and Romanelli, 1985) the resistance to change can be related to cognition, motivation and obligation. Organisational inertia or stability can also be seen from a different perspective; if the existing high order of an organisation and its environment remain consistent, then the company might

become more skilled at what it does due to commitment to the company's course.

During incremental change the existing high order remains intact. Under the process of radical change the high order must be dismantled before a new high order can be found. Dismantling the high order of a firm means that the company is temporarily disorganised, only to form a configuration that operates according to a new set of rules. Dismantling is initiated if at least one of the basic premises of high order changes. As a result all the premises contingent on the rest are affected as well. This view contradicts the gradualist view which states that companies never move far from their status quo in one step. The process of radical change presents two different tasks; terminating the existing high order and initiating a new one. Romanelli and Tushman (Romanelli and Tushman, 1994) found that within organisations radical change occurred in relatively short periods of discontinuous change where the previously defined five facets are fundamentally changed. Radical change can be induced by internal changes that pull facets out of the existing high order or by environmental changes that threaten the system's ability to obtain resources (Gersick, 1991).

From this perspective, crisis is the main inducement of radical change. According to Tushman and Romanelli (Tushman and Romanelli, 1985) crisis, as the result of performance pressures, can be anticipated or current. Tushman, Newman and Romanelli (Tushman et al, 1986) found that the most successful radical changes occurred in organisations whose managers foresaw the need for radical change and initiated it before any crisis occurred. Initiating a new high order occurs when an organisation turns from confusion towards clarity. The articulation of this new clarity is interpreted as the new vision and is also central to organisational reorientation (Tushman and Romanelli, 1985). Defining a new reality is a complex and often arbitrary process. Kuhn (Kuhn, 1970) noted that perception is a subjective phenomenon: there is always more than one plausible way to interpret reality (Gersick, 1991). Prigogine and Stengers (Prigogine and Stengers, 1984) stressed the unpredictability of the transition itself, stating that it may follow '*a number of equally possible paths*'. As a result, the choice of a path will depend on random fluctuations.

Compared to the relative predictability of equilibrium conditions, neither the mechanics of human cognition nor the system itself absolutely '*dictates*' the outcome of the transition (Gersick, 1991). As Prigogine and Stengers (Prigogine and Stengers, 1984) stated, no one change can convert an entire system instantaneously. Change initially forms a nucleus that establishes a firm position before it can communicate and spread change throughout the system. The findings of Prigogine and Stengers on system analysis or Grand Theory were also supported by Eldridge and Gould (Eldridge and Gould, 1972) based on studies of biological species. Eldridge and Gould (Eldridge and Gould, 1972) found that specialisation must begin rapidly and in populations that are small enough for the change to take hold, in order to avoid being diluted by the parent population (Gersick, 1991). Tushman and Romanelli (Tushman and Romanelli, 1985) found that radical change may change the organisation for the worse during the transition process. This is consistent with the implication of the punctuated equilibrium paradigm that systems do not inevitably evolve toward improvement.

Gersick (Gersick, 1991) stated that the punctuated equilibrium paradigm does not provide an overall view; it is not expected that all organisational changes follow this paradigm: gradualism is rare but does exist. This notion can also be found in the work of Eldridge and Gould (Eldridge and Gould, 1972) who stated that '*nature is far too varied and complex for absolutes*'. Within organisations it is expected that loosely coupled systems in particular (Weick, 1976) have a more fluid form of high order which means that change can be achieved more gradually. The implication for the punctuated equilibrium paradigm is that not every change can be measured and categorised. In order to validate the punctuated equilibrium paradigm Romanelli and Tushman (Romanelli and Tushman, 1994) defined radical and incremental change based on the facets that form high order. In translating the five facets into practical and measurable variables, three variables were defined: strategy (facet 1: products, markets, technology and facet 2: competitive timing), structure (facet 4: the organisation's structure) and power distribution (facet 3: the distribution of power and facet 5: the nature and persuasiveness of the existing control systems). Radical change was defined as a change in all three variables within any two-year period. Incremental change was defined in two ways: firstly, a change in all three parameters within a time horizon longer than two years and

secondly, small annual changes in all three variables which ad up to 30% and when all three parameters exhibit this level of change, this is also recorded as incremental change. An empirical test by Romanelli and Tushman (Romanelli and Tushman, 1994) found that radical change occurred with an average of 1.17 years, 40% shorter than the two-year boundary. Therefore it can be concluded that radical change most frequently occurs in very short periods.

2.3 Strategic management and the punctuated equilibrium paradigm

In order to position the punctuated equilibrium paradigm within strategic management, a framework has been developed in which industry-based strategic management (Annex B.1), resource-based strategic management (Annex B.2) and the punctuated equilibrium paradigm can be placed. The framework uses reference point theory (Kahneman and Tversky, 1979), generic firm processes and the stakeholder approach to position the punctuated equilibrium paradigm. Generic firm processes are chosen as processes stress the dynamics of a company and its ability to learn. Secondly, through processes, aspects such as ambition, forming resources and value creation can be linked without adopting a specific strategy framework. The stakeholder approach is chosen since it provides an insight into the economics of scarcity and, when both the stakeholder and the company define the relationship as existent, question the delicate boundaries of a firm. Combining generic firm processes and the stakeholder approach provides a framework in which the punctuated equilibrium paradigm can be positioned in relation to the resource perspective of companies.

2.3.1 Generic firm processes

The Austrian school of thought defines economics as a process, not as a static exchange between individuals and hence identifies time as an essential aspect of the economic process. It sees competition as a dynamic process through which large profits will be eliminated over time. At the same time large profits play an important role in driving the system. It is this process that drives individuals to an equilibrium, a process that emphasises the role of the entrepreneur in reducing uncertainty. According to the Austrian school, the

market place is the best instrument for achieving individual freedom. According to Hayek (Hayek, 1945) markets and the process of competition are the result of the discovery of previously unavailable knowledge (Nooteboom, 1989). According to Austrian economics, individuals are assumed to operate in a changing environment in which information is limited and the future unknown. As a result of this uncertainty, coordination of individual plans is difficult and beyond a single individual's comprehension. The system only works through spontaneous order that develops through the market. As a result of spontaneous order we do not know the ultimate result of our actions.

The process of learning, which is crucial to the punctuated equilibrium paradigm, can also be explained by Austrian economics in which the market is viewed as a discovery process: economic agents not only have different preferences, they also have different knowledge (different minds think different things). As a result, the Austrian school focuses on the variety of agents and views the market as a process of learning and preference formation. The essential element is how knowledge is acquired and communicated (Hayek, 1945). The acquisition and communication of knowledge is studied in cognitive sciences, but has to fit in a framework where knowledge is related to specific investments and questions of dependence and governance (Nooteboom, 1992). Similar to the Austrian school, cognitive science states that people perceive, interpret and evaluate the world according to categories of thought they have developed in interaction with their physical and social environment (Simon, 1955). The existence of these categories enables cognition, but at the same time may constrain cognition. As a result cognition is company-specific and path-dependent (Nelson and Winter, 1982); it is not only the current social and physical environment that counts but also their history. The existence of company-specific cognition categories means that companies cannot be copied, while the absorption capacity of companies (Cohen and Levinthal, 1990) dictates what fits in their respective path-dependent trajectories. As a result, companies will compete from a different perspective than their competitors do. The existence of path-dependent trajectories stresses both the resource or competence view of the firm that states that a company is a configuration of technology and organisation (Foss and Knudsen, 1996; Penrose, 1959) and a process orientation of the strategy process (Baaij et al, 1999; Eisenhardt and Brown, 1999).

The resource perspective defines resources and not a company as an economic element and both the punctuated equilibrium paradigm and the resource perspective stress learning, which means that a company can be defined as a process or as a coherent group of specific processes. Based on the description of the two major schools of strategic management (Annex B: figure 8 and Annex B: figure 12) and the comprehensive literature study at the basis of it, the existence of company processes can be aggregated towards generic firm processes. Within a company several processes can be recognised, each of which influences the other processes of the company. Through aggregation, based on the analysis provided in Annex B, five generic processes are identified. The process of forming resources, with its background in resource-based strategic management, is directly related to the process of forming the company perspective (1), which forms the backbone of the strategy process of the firm (Annex B: figure 12). The production process is related to the process of value creation (5) (Annex B: figure 8). Both theories aim to create value for the firm (5), however they use different definitions of value. Resource-based strategic management defines value and hence success as long-term dominance, whereas industry-based strategic management defines profits as value.

- Process of forming the company's perspective (1)

  The process of forming the company's perspective can be defined as the process of forming the '*company's theory of the business*' (Drucker, 1994) or the mental model of the company. The mental framework implies perceptions as well as explicit and implicit assumptions concerning environmental change, resources, competencies, assets and positional advantages. Following Prahalad and Hamel (Prahalad and Hamel, 1991), the process of forming the company's perspective is related to the vision of the company and its interpretation as strategic intent. Others, like Dosi (Dosi, 1982) and Nelson and Winter (Nelson and Winter, 1982), found that the perspective of the company is strongly influenced by company-specific paths, defining the importance of historical events. Industry-based strategic management on the other hand, stresses external influences that dictate the company's outlook.

- Process of forming resources (2)

  The process of forming resources concerns which competencies, assets and positional advantages (Stoelhorst, 1997) are needed, which of them should be developed internally, and which of them are unique. Positional advantage can be related to competitors, customers, employees, shareholders and partners (Stoelhorst, 1997). Following resource-based strategic management, the process of forming resources is greatly influenced by the vision developed. Porter (Porter, 1980; 1985) however, stresses the development of external positional advantages as part of the process of forming resources.

- Process of configuration of production (3)

  The process of configuration of production and facilitating production concentrates on turning resources into products and services. According to the industrial organisation theory the process involves translating the strategic position into a process of configuring the organisation and includes procurement, technology development and human resource management. Based on the resource view, the process configuring production and facilitating production is oriented towards turning resources into products that fit the formulated vision.

- Process of production (4)

  The process of production uses primary activities (Porter, 1985) and by that transforms intermediates into products and services to gain a sustainable advantage or a defensible position. The resources provided by employees and shareholders are functional. Primary activities are inbound logistics, operations, outbound logistics, marketing & sales, and distribution. From the resource perspective, production is defined as a method to exploit core competencies (Hamel and Prahalad, 1993).

- Process of value creation (5)

  Based on the results of the process of production the process of value creation aims to realise success in terms of long term dominance or profits.

Figure 2.1 shows the five generic firm processes and the positioning of resource-based strategic management using the framework of generic processes.

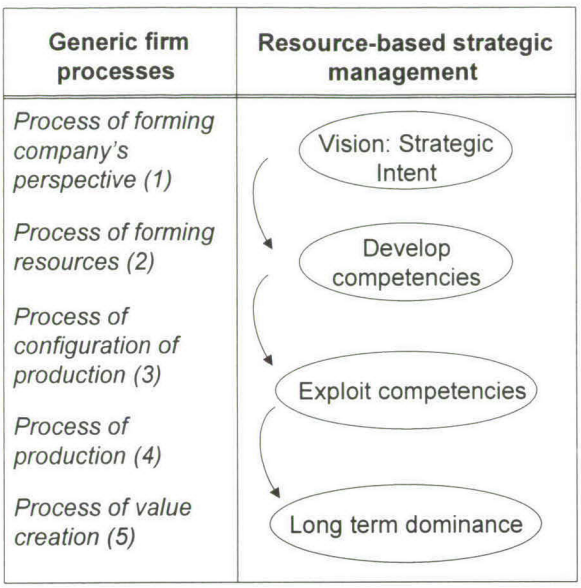


Figure 2.1: Positioning based on generic firm processes

An essential aspect of the punctuated equilibrium paradigm is high order. Gersick (Gersick, 1991) defined high order as a set of coherent interdependent implicit and explicit choices that form the basic configuration into which a system is organised. This means that the process of forming the company's vision must be embedded in the resource perspective as the most stable elements and thus as the process with the highest hierarchy. As high order is defined as the most stable aspect of a firm, high order should be positioned in relation to the fundamental unit of analysis and the core of the strategy process, i.e. the process of forming resources and the process of forming the company's perspective. Radical change therefore has to do with changing the process of forming the company's perspective and changing the process of forming resources. As resources are bound to the company's current perspective, Barney concluded that the resource perspective is unable to handle Schumpeterian revolutions (Barney, 1991). This stresses the necessity for slack resources (Cyert and March, 1963) which may not be directly useful within the

company's current perspective but might be valuable when adopting a different perspective. The combination of productive and slack resources forms the '*tolerant company*' (de Geus, 1997) which can be best understood as the resource heterogeneity of the firm. According to Barney (Barney, 1991) the company focuses strictly on external factors such as competition and industry structure. This externally driven learning will only be possible if the industry structure and competition is stable and high order can be related to the core of the strategy process, i.e. the industry structure. Even if learning is induced by external developments it is not likely these developments are just industry-specific. With the growth of cross-industry competition, rapid technological change and rapidly shifting market conditions (Coyne and Subramaniam, 1996; Teece et al, 1997) industry structure may not be the only factor that induces corporate change.

2.3.2 Stakeholder approach

The stakeholder approach identifies different groups in relation to the economic self-interest of the company and hence should not be confused with the '*benevolence*' of the company in relation to its environment. The existence, intensity and content of the interactions between different stakeholders and a company is company-specific (Wheeler and Sillanpaa, 1998), and is related to the specific circumstances of the company and the economic importance, based on impact and scarcity, of the different stakeholders. The result of the interactions between the company and its stakeholders is a dynamic interactive form of order, which continually changes as the impact or scarcity of the stakeholders change. The fundamental background to this type of interactive order can be traced back to Adam Smith (Landreth and Colander, 1994) and even to the ancient Greeks who strongly believed in the existence of natural order as the opposite of artificially created order (Roll, 1992).

The resource orientation of a firm, including different positional advantages as part of the firm's resources, implies that efforts to gain reputation, brand loyalty and therefore competitive position, may play a role in defining the strength of a firm related to its resources. Positional advantage should be related not only to competitors but to all parties which the company aims to have a lasting, loyal and probably symbiotic relationship with. The stakeholder

approach identifies a wide range of stakeholders. For the purpose of strategic management a selection has to be made. Under the stakeholder approach, parties are chosen who accept the relationship is mutually accepted and have a direct relationship with the wealth of a firm. As a result, stakeholders that are part of general or societal or interest groups are filtered out so that only company-specific stakeholders remain. The remaining parties are defined as the core stakeholders of the company and are groups of customers, employees, partners and shareholders. As a result the boundaries of the firm as a legal entity may differ from the boundaries of the firm resulting from the stakeholder approach which leads to the conclusion that no clear demarcation of the company can be found.

Resource-based strategic management focuses on the combination of core stakeholders to gain long term dominance. As a result the cooperation between the core stakeholders is led by opportunism and trust, which may both extensify and intensify co-operation. It was Durkheim who stated that social integration occurs in the microcosm of the process of exchange between contracting parties. In true contractual relationships noncontractual elements are also developed. Therefore a pure contract does not exist while in any *'contract not everything is contractual'* (Durkheim, 1893; Etzioni, 1988). Durkheim concluded that a strict division of contracts into 'economic' and 'social' aspects is not appropriate. In addition, it has been argued (Hodgson, 1988) that social exchanges do not involve property rights and thus are not 'exchanges' at all. With the inclusion of non-contractual elements in formalised contracts, elements like trust, cohesion and solidarity can be explained (Heiner; 1983; Nooteboom, 1996; 1999c; North, 1990; Ouchi, 1980). The inclusion of noncontractual elements implies that economic behaviour could be explained using a social institutional framework. This framework depends not only on organisational structures but also on normative patterns. Individual goals and interests are formed within these patterns. Routines influence economic behaviour and play an important stabilising role in the economy (Stein, 1995). According to Hodgson *"Routines are the substance, rather than merely the boundaries of social life"* (Hodgson, 1988). Hodgson defines markets as *"a set of social institutions in which a large number of commodity exchanges of a specific type regularly take place, and to some extent are facilitated and structured by those institutions"* (Hodgson,

1988). The most probable reason for the existence of markets is that a market structure will decrease the transaction costs of trade. However, not all trade is handled in a market place. According to the neo-institutional school of thought, radical uncertainty is related to future developments, which cannot be solved with contracts and risk calculations. This might be the reason why most company resources are not tradable in a market place and why studies on the allocation and governance of resources frequently use the stakeholder approach. The existence of norms and social institutions may result in a process of structuring behaviour (Hodgson, 1998). Therefore, companies provide an institutional framework where instantaneous utility maximisation per core stakeholder is minimised, which creates trust, loyalty and dedication towards the company (Hodgson, 1988; 1998). Goshal and Bartlett (Goshal and Bartlett, 1997) provide examples of these types of 'contracts'. The punctuated equilibrium paradigm stresses aspects of learning by combining and recombining different processes and the interdependence of these processes. Within the punctuated equilibrium paradigm all core stakeholders are able to alter the core beliefs and values of the company (Tushman and Romanelli, 1985) which is accepted by all the defined core stakeholders. By using the stakeholder approach the allocation and governance of specific groups of core stakeholders can be analysed.

2.3.3 Punctuated equilibrium paradigm and strategic management

Based on the analysis of generic firm processes, the stakeholder approach and the associated aspects of learning, it can be concluded that the resource perspective encompasses the punctuated equilibrium paradigm. Both theories also state that as a result of path-dependency, companies can be characterised based on their learning, their 'logic of development' or their 'routines' (Nelson and Winter, 1982). Routines are the result of a configuration of technology and organisation or the result of an institutionalisation of groups of core stakeholders of a company based on the implicit or explicit vision, norms and values.

The processes of learning and change form the very heart of the punctuated equilibrium paradigm (Gersick, 1991). The essential difference between incremental and radical change is that incremental change is about aligning and

can be related to the process of production and value creation, while radical change is about the process of forming a company's perspective and the process of forming resources. The punctuated equilibrium paradigm is about adaptation on two levels within the company's vision or the exploitation of old certainties and about the process of forming a new vision or the exploration of new possibilities (Nooteboom, 1999d). The difference between incremental and radical change can also be related to first-order versus second-order learning (Fiol and Lyles, 1985; Hedberg et al, 1976) and single-loop versus double-loop learning (Argyris and Schon, 1978; Romme and Dille, 1997). The existence of path-dependencies and the two types of learning implies that a distinction is made between the creation of novel 'techno-economic paradigms' and the movement along these 'technical trajectories' based on such paradigms (Dosi, 1984; Dosi et al, 1988; Freeman and Perez, 1989). In the innovation literature, the creation and stability of novel 'techno-economic paradigms' was originally studied by Schumpeter (Schumpeter, 1934). While stressing non-economic causes of growth it was Schumpeter, as opposed to Marx, who stated that depressions are self-correcting and beneficial to the system; they are an integral part of the entire process of economic growth. Depressions shake out the economy and remove less efficient firms and thereby prepare the way for a growing economy of healthy, well-managed and efficient firms. The principal agents of the economy are to be found in the institutional structure of society and are non-economic. It is Schumpeter who stressed what we now call '*an entrepreneur*', as someone different from a manager or businessperson who introduces innovative products and new technologies into the economy. After the introduction of a successful innovation by the entrepreneur other businesspersons will follow and the new technology will spread throughout the market. Unlike the classical economists, Schumpeter stated that instead of capital accumulation, cultural and sociological factors were the principal agents of growth.

Radical change is defined as Schumpeterian novel combinations leading to creative destruction (Schumpeter Mark I) or creative accumulation (Schumpeter Mark II). Radical change implies a shift away from the existing path and related path-dependent trajectories and results in a new perspective for the company; it has a direct impact on the process of forming resources and is defined as second order learning. Radical change can be induced by the

environment but also by the company itself and implies a new mental framework or a new perspective, and includes choices made regarding the definition of the business, competencies and other resources. Within a new perspective, current slack resources may be transformed in functional resources. While companies are continually confronted with new competitors and new products or services that make theirs less interesting or even obsolete, most companies aim to create a radical change themselves and adapt during this process. A new perspective will result in a change of resources like competencies and positional advantages and, as a result, in the core stakeholders and combination of core stakeholders which create these resources. Within a company's perspective the core stakeholders and the combination of the core stakeholders are relatively stable which can be interpreted as a form of 'loyalty' between the core stakeholders and the company. Studies by Reichheld (Reichheld, 1993; 1996a; 1996b) show that customer loyalty pays off but it can be reasoned that this also applies to other core stakeholders. To reduce the level of risk, no company will change all of the above elements at once. However, radical change creates a different perspective and will influence the development of competencies and the relationship that the company has with its core stakeholders.

Incremental change is defined as a change in the process of production and the related orientation of the value creation process. Incremental change does not directly influence the perspective of the company or the process of forming capabilities and is defined as first order learning. Ambidextrous organisations combine the alignment of strategy, culture and processes, and at the same time prepare for the inevitable revolutions required by discontinuous change. Incremental change is about increasing the integration of strategy, culture and processes. Integration or aligning is defined as a company-specific process of first-order learning and concentrates on the process of production. The company's perspective and its process of forming resources limit the process of first-order learning. Incremental change may occur within one specific perspective which is comparable with the findings on stability and change related to first-order versus second-order learning (Fiol and Lyles, 1985; Hedberg et al, 1976) and single-loop versus double-loop learning (Argyris and Schon, 1978). Following these findings the optimising variable of the process of first-order learning or single loop learning will differ from the optimising

variable related to the process of forming the company's perspective, i.e. long-term dominance. As a result, the optimising variable for the combination of the process of value creation and the process of production may be profits, cash flow or any other variable that can be related to short term exploitation, alignment or 'fitting the organisation'.

Inherent to their quantitative model, Romanelli and Tushman (Romanelli and Tushman, 1994) defined change as incremental or as radical. In developing a framework to detect and measure the balance between exploitation or incremental change, and exploration or radical change, these forms of change should not exclude one another. Therefore, the quantitative model of Romanelli and Tushman needs to be adjusted. Different and thus exclusive variables for exploitation and exploration are essential to ensure that the interplay between exploitation and exploration or the absence of such interplay can be measured. Further to an analysis of exploitation and exploration in Chapters three and four, the quantitative model is proposed in Chapter six. Figure 2.2 shows the different change processes.

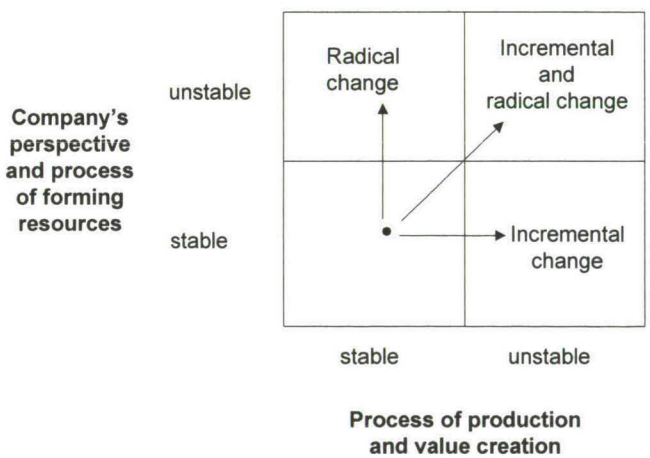


Figure 2.2: Processes of change

The differences between incremental and radical change are related to the different generic firm processes, the orientation of the core stakeholders and the different aspects of adaptation or learning. Given the punctuated equilibrium paradigm it is expected that the stability of the process of forming

the company's perspective is higher than the production process or the value creation process. The process of forming the company's perspective heavily influences the production process and the value creation process. The first process provides boundaries based on the vision, resources and related perceptions and assumptions towards the process of production and the value creation process (Figure 2.3). The process of production configuration, which includes technology development and human resource management, is crucial since it structures the production process within the company's perspective and combines the development and deployment of resources.

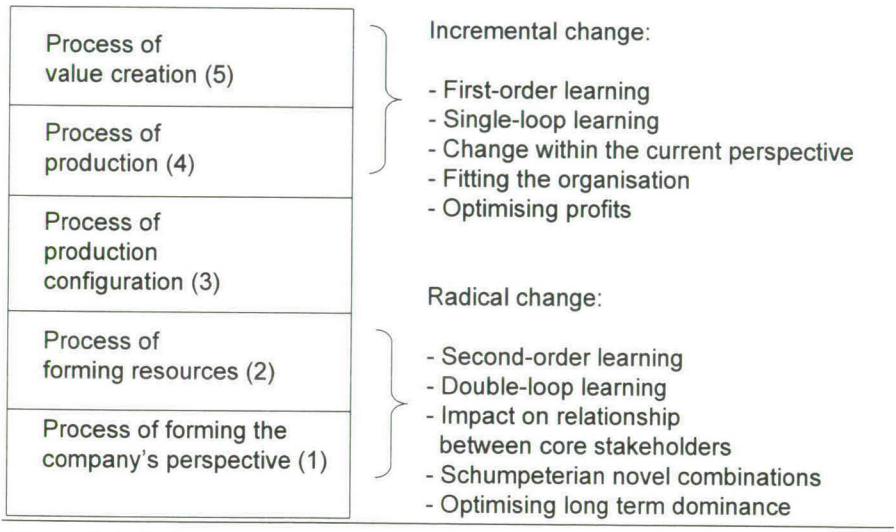


Figure 2.3: Relationships and differences between incremental and radical change

The operationalisation of the resource perspective, and thus the competence approach developed by Prahalad and Hamel (Prahalad and Hamel, 1989; 1990; 1991), mainly focuses on the relationship between competence development and the perspective of the company which means that competition has to be defined more accurately. Following the stakeholder approach it is scarcity that creates competition, which implies that competition is not only related to winning customers and their buying power but is also related to win employees, partners and shareholders. A balance has to be found, depending on the level of scarcity of the different core stakeholders, the content of the generic firm processes and the inputs provided by the core stakeholders. From

this perspective, competition is defined as a multi-layered process. Exchanges between the core stakeholders and the different levels of scarcity between the core stakeholders generate competition at the firm level. There is also competition between a company and its environment, which focuses on keeping and gaining relevant core stakeholders. This implies that competition is not industry-specific and may have a deep and broad impact on the structure and behaviour of a single company.

By using different parameters for incremental and radical change a company is caught between two opposing poles of optimisation: long term dominance versus short-term profits, cash flow or any other representation of exploitation. Different generic firm processes focus on developments related to incremental or radical change but are intertwined because the different generic processes are parts of the same single company. According to March (March, 1991) combining and balancing exploration and exploitation is essential. Contrary to the current deployment of the punctuated equilibrium paradigm, it is concluded that the proposed framework must provide the ability to measure incremental and radical changes not only alternately but also simultaneously and thus measure the balance between exploitation and exploration. The interdependence between exploitation, exploration, generic firm processes and the stakeholder approach is further developed in the next section through the use of the contractual theory of the firm.

2.4 Contractual theory of the firm

The punctuated equilibrium paradigm, which is closely related to the resource perspective, can be analysed using the contractual theory of the firm. However this theory was developed to analyse the allocation of different input-factors (Coase, 1937; Williamson, 1975), recent studies (Nooteboom, 1999c; Peteraf, 1992; Pitelis, and Pseiridis, 1999; Silverman 1999; Slater, 1997) concluded that combining contractual theories and the resource perspective provides useful insides into the allocation, accumulation and governance of resources. The level of aggregation is a single firm and the core stakeholders the company interacts with (Spulber, 1994; 1999). Inputfactors delivered by the core stakeholders can be allocated either by the market or by hierarchical control mechanisms. According to Coase, hierarchical control is a substitute for market

competition and the actual choice of governance is based on information requirements and information imperfections. The presence of transaction costs and organisation costs dictate how transactions should be governed. The contractual theory of the firm focuses on the firm and its trading partners. For the purpose of this study the core stakeholders and their interaction with the company form the essence of this analysis. From this perspective the exchanges between the firm and the core stakeholders ask for core stakeholder-specific governance, which differs from the principal-agent perspective where the relationship is one-sided (Nooteboom, 1999c). Under the definition of core stakeholders the exchanges between the firm and its customers, employees, partners and shareholders may occur frequently, which results in bilateral governance (Williamson, 1985) to ensure that the dependence on each other is beneficial for both the company and the different core stakeholders. Transaction costs will occur due to information imperfection and opportunism,. The defined core stakeholders have different levels of scarcity and hence different values for the company, the firm also has a different value for each of the core stakeholders.

Aspects	Contractual theory	Applied contractual theory
Level of aggregation	Single firm with its trading partners	Single firm and its core stakeholders
Allocation of resources	Market structure as the most efficient instrument for resource allocation	During the process of radical innovation market structures are the most efficient instrument to select and attract core stakeholders
Governance structures	Because of information imperfections opportunism is limited by developing governance structures	During the process of incremental innovation bilateral governance structures, such as contracts, between the company and the defined and allocated core stakeholders, are developed and utilised

Figure 2.4: Applied contractual theory of the firm

Given the defined path-dependency of companies, the preference formation that continuously takes place and the discovery of previously unavailable knowledge, it is expected that companies enter into contracts with their different core stakeholders. These contracts have to ensure a lock-in situation whereby both parties gain from each other and where opportunism by the firm and by the different core stakeholders is limited. These contracts should not be seen as 'fully formal contracts' (Nooteboom, 1992) but merely as a framework in which both the company and the core stakeholder agree on having different objectives and serving each other in realising their specific objectives. Due to information imperfections and preference formation, trust, cohesion and loyalty, as non-contractual elements, are of major importance. For both the company and the core stakeholders different objectives related to different planning horizons can be observed. Employees for instance would like to maximise their salaries in the short run but want to have job security and career development on the long run.

From this perspective the contractual theory can be applied to analyse exploitation versus exploitation (Figure 2.4). The process of preference formation and learning and hence innovation requires interaction between the different core stakeholders and the firm and an identity is developed through these interactions (Nooteboom, 1992; Varela, 1991). The contracts and the safeguards, as defined by Williamson (Williamson, 1985), between a company and its core stakeholders are essential to organise and govern these interactions. From this perspective, contractual theory is not only relevant to analyse 'make or buy' decisions but also to define the appropriate governance structures related towards the different core stakeholders.

Following the applied contractual theory, bilateral governance seeks a balance between the objectives of the different core stakeholders and the objectives of the company through specific close coupling to induce development and learning, and loose coupling to minimise organisational costs. These balances can also be related to the planning horizon of the firm as well as the planning horizon of the core stakeholders. By using generic firm processes both long and short-term objectives can be identified. A short term focus by a firm and

the core stakeholders stresses opportunism, while a long term focus stresses the perspective of the firm in relation to the long term objectives of the core stakeholders (Figure 2.5).

Aspects	Exploitation: short term focus	Exploration: long term focus
Driving force	financial value	long term dominance
Generic firm processes	process of production and value creation	company's perspective and process of forming resources
Learning aspects	single-loop or first-order learning	double-loop or second-order learning
Stakeholders	short term gains or opportunism by core stake-holders and the firm	combining long term perspective of the firm with long term objectives of the core stakeholders

Figure 2.5: Firm and core stakeholders: the perspective of contracts

2.5 Concluding remarks

Ambidextrous organisations or companies that deploy the punctuated equilibrium paradigm combine exploitation with exploration. The process of first-order learning or exploitation is related to decreasing uncertainty and can be traced back to the neo-classical theory and the Austrian school of thought. Second-order learning is non-adaptive and related to exploration and increasing uncertainty and may lead to creative destruction. By combining exploitation and exploration, the punctuated equilibrium paradigm will, under reference point theory, be positioned as 'time' related. With its focus on combining exploitation and exploration, resources are the fundamental units of analysis of the punctuated equilibrium paradigm, since resources provide the basis for exploitation and may develop through exploration. Under the

punctuated equilibrium paradigm the concept of learning is essential, which results in the use of the resource perspective.

According to the Austrian school the market place is the best instrument for achieving individual freedom. According to Hayek (Hayek, 1945), markets and the process of competition arise from the discovery of previously unavailable knowledge. The process of learning is necessary to operate in a changing environment in which information is limited and the future unknown (Garavan, 1997). As a result of this uncertainty co-ordination of individual plans is difficult and beyond a single individual's comprehension. The defined generic firm processes, the specialisation and optimisation per process and the interplay between these processes result in a continuous process of learning where a balance between the exploitation of old certainties and the exploration of new possibilities can be found.

The role of strategic management is to create successful ambidextrous organisations, which are simultaneously active in aligning resources and processes with their current strategy, and preparing for and initiating radical innovations. This characteristic of strategic management follows the punctuated equilibrium paradigm (Gersick, 1988; 1989; 1991; Miller & Friesen, 1980; 1984; Romanelli and Tushman, 1994; Tushman and O'Reilly III, 1996; Tushman and Romanelli, 1985) and aims to influence the long-term wealth of a company.

A change in the company's perspective may lead to a different combination of core stakeholders as different resources are needed. A new combination of resources will result in a different productivity of its resources and can be realised by speeding up the learning curve, finding new combinations of resources that fit the company's current perspective by increasing the level of knowledge based on new developments and experiences. To mark the difference between the proposed definition of radical change and the definition as provided by Tushman and Romanelli (Tushman and Romanelli, 1985), radical change is defined here as radical innovation and implies a change of high order and hence a change in the development of new resources. Radical innovation is defined as Schumpeterian novel combinations and implies a shift from the existing path and related path-dependent trajectories and results in a

new perspective of the company. According to innovation literature, the creation of novel 'techno-economic paradigms' can be induced exogenously, which implies Schumpeterian creative destruction, or by a company itself which implies creative accumulation. Radical innovation has a direct impact on the process of forming resources and can be related to second-order learning. A new perspective will result in a change of resources like competencies and positional advantages as well as in a change of core stakeholders.

Incremental change is implicity influenced or explicity steered by the company's vision or perspective. As a result it is assumed that within the company's perspective the process of resource build-up is stable. To mark the difference between incremental change as defined by Tushman and Romanelli (Tushman and Romanelli, 1985) and the definition of incremental change proposed here, the latter one will be defined as incremental innovation. 'Innovation' is not only chosen to mark a difference with the model developed by Tushman and Romanelli (Tushman and Romanelli, 1985) but also to express that these changes are deployed and found useful (Kuznets, 1930). Incremental innovation is about aligning fit to strategy, culture and processes. Aligning is defined as a company-specific process of first-order learning and concentrates on the process of production. The process of first-order learning is limited by the company's perspective and its process of forming resources. Incremental change is directly related to the process of value creation and the process of production.

Within the stakeholder approach, all core stakeholders are essential to the punctuated equilibrium paradigm. The importance of each core stakeholder may differ per firm as well as the scarcity per stakeholder. This approach makes it possible to combine and recombine the different resources created by the core stakeholders and a combination of core stakeholders. The process of combining and recombining resources uses the resource perspective and can best be understood by using contractual theories of the firm. Combining and recombining resources can be seen as a result of company-specific learning which is based on its 'logic of development' or 'routines' (Nelson and Winter, 1982). Combining resources results in a configuration of technology, which is based on the creation of novel 'techno-economic paradigms' and the

movement along these 'technical trajectories' and the institutionalisation of groups of core stakeholders.

Romanelli and Tushman (Romanelli and Tushman, 1994) used the same variables, namely change of strategy, power and structure, to detect incremental and radical change. Time was used to differentiate between incremental and radical change. Contrary to Romanelli and Tushman (Romanelli and Tushman, 1994) this framework uses different processes to describe incremental and radical innovation and hence uses different perspectives for optimisation. The five generic firm processes form a hierarchy based on longitudinal stability. Using different variables focusing on different time horizons, the process of finding an optimum perspective and optimum value creation is time and company-specific. The interaction and mutual influences between a company and its environment, the five generic processes and the scarcity of core stakeholders and the company, imply that no optimum can be found by abstract or hard analysis.

Given the developed framework, the punctuated equilibrium paradigm may be useful in analysing the 'exploration – exploitation' dilemma. To be ambidextrous and to successfully combine incremental and radical innovations, a company has to focus on innovation as well its level of stability. Innovation is essential as a basis for change and stability is essential so that learning can take place. This study focuses on aspects of stability and change on both exploitation and exploration (Figure 2.6). Based on the analysis presented in this Chapter it can be concluded that the adjusted punctuated equilibrium paradigm provides a conceptual framework to analyse the behaviour of companies within the exploration – exploitation dilemma.

Before stability and change in exploitation and exploration can be detected, these aspects have to be defined. These definitions will be derived from the findings of the analyses presented in this Chapter on the relations between generic firm processes, stakeholder approach, exploitation and exploration. In this way, exploitation and incremental innovation, which will defined in Chapter three, will be related to the process of production and the process of value creation.

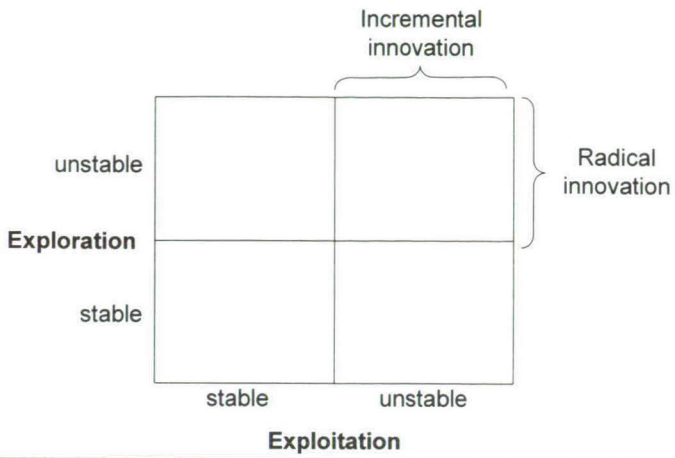
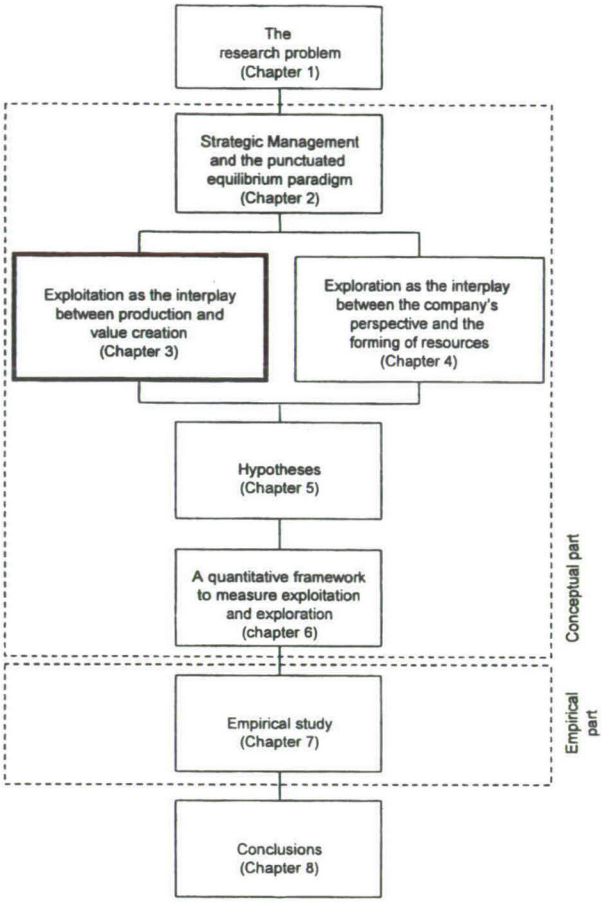


Figure 2.6: Innovation and stability: the essence of this study

In Chapter four exploration and radical innovation will be related to the company's perspective and the process of forming resources.


The research problem (Chapter 1)
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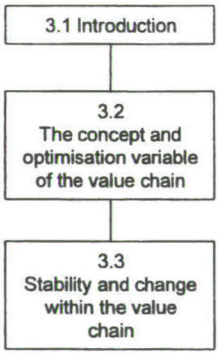

3.1 Introduction
3.2 The concept and optimisation variable of the value chain
3.3 Stability and change within the value chain

3. Exploitation as the interplay between production and value creation

3.1 Introduction

A definition of stability in exploitation and incremental innovation is essential to detect stability or incremental innovation. Optimising the process of production and value creation has to do with aligning or 'fitting the organisation' and can be achieved within the boundaries of the company's perspective. The processes that underlie exploitation and exploration differ as well as the time span of optimisation of these processes, therefore different optimisation variables are necessary. In Chapter two it was concluded that exploitation uses a short time frame to optimise the process of production and the process of value creation. Within the boundaries of the company's perspective an optimisation variable needs to be chosen that can be related to the process of production and the process of value creation. In this chapter stability and incremental innovation, which are two mutually exclusive aspects of exploitation, will be defined by using the concept of the value chain. The concept of the value chain and hence value chain analysis is chosen since this concept is a generally accepted method to analyse the process of production in relation to the process of value creation.

3.2 The concept and optimisation variable of the value chain

Following neo-classical economics, which originally defined a company as a production function converting inputs into outputs, McKinsey & Co. (Buaron, 1981; Gluck, 1980) defined the company as a series of different functions. By using the McKinsey & Co. model, Porter (Porter, 1985) developed the actual concept of value chain analysis. Within the value chain, several discrete activities are recognised, such as designing, producing, marketing, delivering and servicing products. These discrete activities are defined as elements of the production process. The value chain disaggregates a company into relevant activities in order to understand the behaviour of the production process, related to the value creation process (Figure 3.1).

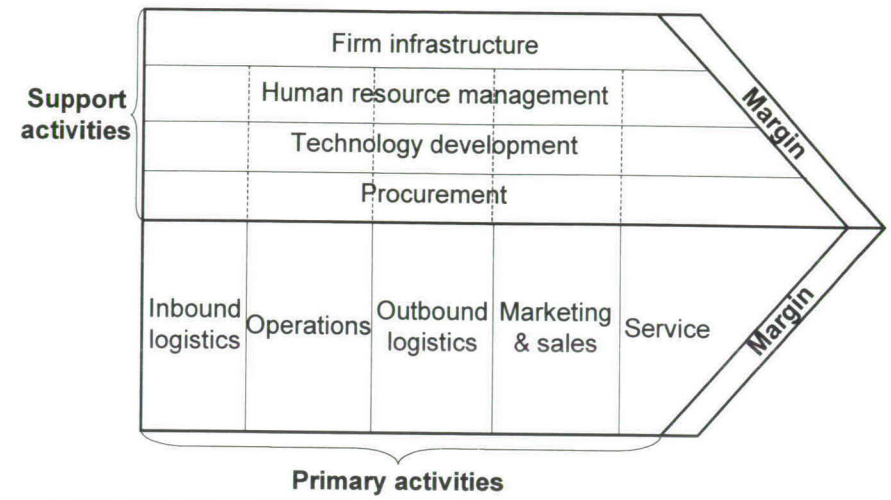


Figure 3.1: Value chain

A company's value chain is embedded in a larger stream of activities, which is called the value system (Figure 3.2).

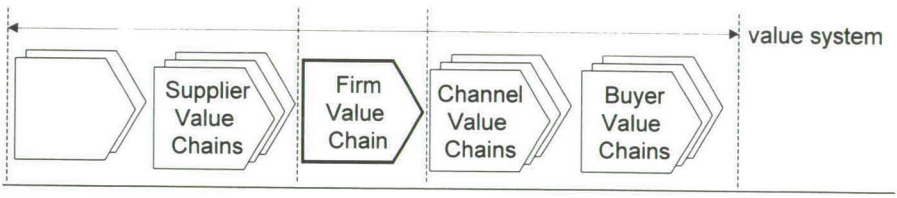


Figure 3.2: Value system

The value chain displays the total value, and consists of value activities and margin. Value activities are the physically and technologically distinct activities a company performs. These are the building blocks by which a company creates value. The value chain is not a collection of independent activities, but a system of interdependent activities. Links can lead to competitive advantage through optimisation and co-ordination and often reflect trade-offs between activities to achieve the same overall result. Links between other value activities arise from a number of generic causes, such as performing the same function differently, improving the total cost level by increasing indirect activities, or reducing the cost level, the need to demonstrate, explain or service a product in the field by expanding activities

within the company. Value chain analysis is used as a basic tool for diagnosing competitive advantage and finding ways to create and sustain competitive advantage and to position and align the company based on external opportunities (Porter, 1985).

The value chain with its neo-classical background and its focus on external opportunities is mainly used as an instrument deployed within the framework of industry based strategic management. Given the resource perspective of the punctuated equilibrium paradigm, the concept of the value chain and thus value chain analysis should not be related to aligning the company with external opportunities but with the existing high order of the company. With its focus on production and value creation as generic processes oriented towards exploitation, value chain analysis is accepted as an instrument to analyse exploitation oriented towards alignment with the company's perspective or high order. Given the resource perspective, value chain analysis (with its focus on the relation between the process of production and the process of value creation) is more important than value system analysis, with its external focus on competitive analysis and competitive analysis.

Every production function within the value chain is defined as a value activity that implies purchase input, human resources and some form of technology to perform its function. Each value activity uses and creates information, such as buyer data, performance variables and product failure statistics. Value activities may also create financial assets, such as inventory and accounts receivable, or liabilities such as accounts payable (Porter, 1985). The margin is the difference between the value to its buyers and the collective cost of performing the different value activities (Porter, 1985). The different value activities can be divided into primary activities, such as inbound logistics, operations, outbound logistics, marketing and sales, and service, and support activities such as technology development, human resource management and company infrastructure (Porter, 1985). By expressing production functions as activities, Porter states that examining all activities that influence the performance of a company and how these activities interact is essential in an analysis of the sources of competition (Porter, 1985). Subdividing too many activities may lead to a situation where, for example, every machine in a factory could be treated as a separate activity, which results in too many

activities. The appropriate degree of disaggregation depends on the economics of the activity and why the value chain is being analysed (Donelan and Kaplan, 1998; Porter, 1985). Defining relevant value activities requires that those activities with discrete technologies and economics be isolated. Broad functions, such as manufacturing or marketing, must be subdivided into different subactivities.

The optimisation variable of the traditional, or Porterian, value chain and thus of its components, is profits or cash flow. A change of alignment from external opportunities towards the high order of the firm does not change the optimisation variable. As a result the optimisation variable of exploitation or the process of production and the process of value creation is financially oriented. A study by McKinsey & Co. (McKinsey, 1991) found that the increase in corporate value of several of 15 large American companies could be traced back to three sources: operational value creation by the business units (64%), portfolio management (22%) and financial engineering (14%). Concentrating on exploitation or the alignment towards high order stresses operational value creation and portfolio management as the major sources of stability and change within the value chain of a company. This is because both aspects may influence the configuration of the value chain as well as the process of value creation. Based on the findings of McKinsey & Co., that operational value creation and portfolio management are responsible for 86% of the total value creation, the choice of a financial variable to determine the development of exploitation on a company level is obvious.

3.3 Stability and change within the value chain

The configuration of the value chain changes continuously, not only as the result of portfolio changes, but also as the result of operational changes such as the development of new products and services, cost reduction programmes and programmes that focus on operational effectiveness in general. Within the last twenty years several programmes, such as Just-in-Time, Total Quality Management, Business Process Re-engineering, Lean Production and Mass Customisation (Annex C), were developed and implemented and had a direct impact on the configuration of the value chain. As a result the stability and change on the configuration of the value chain have to be aggregated to such a

level that specific focuses or generic configurations of the value chain of each company can be defined. The configuration of the value chain has been studied frequently, in relation to the existence of generic strategies. Contrary to Porter, the chosen resource perspective does not primarily focus on competitors or industry groups to judge a company's position. As a result a specific focus or the generic configuration of the value chain must be related to the success of the company itself and thus related to the financial variable which is chosen to determine the development of exploitation on a company level. Following the resource perspective a deployment of a specific focus or generic strategy should be related to the development of the company itself and implies the use of 'time' as a reference point for the financial variable to determine the stability and development of exploitation on a company level.

Several authors generated generic strategies (Buzell, 1975; Porter, 1980; Utterback and Abernathy, 1975) and several other authors (Dess and Davis, 1984; Galbraith and Schendel, 1983; Hall, 1980; Hambrick, 1983; Karnani, 1984; White, 1986; Wright, 1987) studied the existence of generic strategies and the relevance of these strategies. Studies by Hall (Hall, 1980) and White (White, 1986) question the existence of generic strategies, studies by Dess and Davis (Dess and Davis, 1984; Galbraith and Schendel, 1983; Hambrick, 1983; Karnani, 1984) have confirmed that distinct, consistent and recurring patterns or generic strategies exist and that different generic strategies result in different performance outcomes. Hambrick (Hambrick, 1983) found three different clusters and was able to position 'cost-leadership' and 'differentiation' in two of these clusters. Miller (Miller, 1986), Dess and Davis (Dess and Davis, 1982) and Karnani (Karnani, 1984) also recognised 'cost-leadership' and 'differentiation' as relevant generic strategies, however the latter one was less conclusive on the existence of 'focus' as the third Porterian generic strategy (see Annex D). Most of these studies are qualitative or concluded the existence of generic strategies on a product or SBU-level. Apart from the study by Karnani (Karnani, 1984), no studies were found that used financial analyses to conclude if a company deploys a specific generic strategy.

A generic strategy should be related to the process of production and the process of value creation and should be financially detected on a company level. Karnani (Karnani, 1984) translated two Porterian generic strategies into a

quantitative model based on financial variables and identified, the following generic strategies:

- Efficiency strategy

  An efficiency strategy implies the aim of continuously reducing costs and thus increasing value per unit turnover. Choosing an efficiency-strategy leads to a focus on economies of scale, bringing down the experience curve and reducing overhead. Karnani (Karnani, 1984) focused on a reduction of firm specific costs such as production costs to detect an efficiency strategy and found that these costs should be made independent of scale. The independence of scale can be related to a single product or a single unit turnover. This study focuses on a company as a whole and uses time as the denominator to analyse the position of a company, therefore a single product cannot be used and thus the firm specific costs must be made measurable in cost per unit turnover. As a result an efficiency strategy can be detected if most of the created value can be related to a decrease of company specific costs per unit turnover.

- Added value strategy

  An added value strategy can be detected if most of the created value can be related to an increase of added value per unit turnover. This strategy has several similarities with the Porterian strategy of differentiation since both strategies have a focus on delivering premium value for the customer at a premium price. This premium value can be related to design, branding, product quality, customer service, or dealer network. A successful deployment of an added value strategy implies a trade-off between the premium price the customer is willing to pay and the increased cost development as the result of extensive research, product design and intensive customer support to gain additional margins. Karnani (Karnani, 1984) defined absolute demand (here translated as premium price) as a denominator for an added value strategy, which is comparable with the findings of Hall (Hall, 1980). This translation is accepted assuming that absolute demand implies the absence or minimal price elasticity, which can be related to aspects such as improved product

quality, improved distribution convenience or better customer service. Instead of comparing these improvements with competitors, absolute demand can also be recognised within the company by comparing two time-slots. A successful added value strategy combines uniqueness and customer value with higher margins or added value if the price premium exceeds the extra costs incurred by being unique.

- Volume strategy

  Karnani (Karnani, 1984) stated that production costs should be analysed independently of scale and in the previous item it was concluded that company specific costs should be analysed per unit turnover in order to analyse production costs independently of scale. As a result a volume strategy should be added to provide the possibility of scale-dependence. A volume- strategy can be detected when most of the created value can be related to a higher turnover without changing the added value per unit turnover or company specific costs per unit turnover.

These three generic strategies are based on how a company develops its operational value: by growth of turnover, decrease of costs, or by an increase of added value. A major implication of these generic strategies is that both explicit and implicit choices of a company, its interaction with its core stakeholders, the interaction with the different components of the value chain, and the value system are part of the actual deployment of a specific generic strategy. Based on this conceptual framework it can be concluded that the added value strategy and the efficiency strategy are antagonistic; higher quality cannot be realised by reducing costs (Porter, 1980; Hall, 1980). On the other hand a volume strategy may influence the level of company specific costs per unit turnover. The interrelationships between the different generic strategies were also recognised by Karnani (Karnani, 1984), who stated that an added value strategy and an efficiency strategy are antagonistic but can be represented on a continuum of two dimensions, each dimension representing one of the antagonistic strategies. Due to the existence of the defined continuum the detection of the deployment of a generic strategy can only be recognised on a longitudinal basis. The existence of a two-dimensional continuum, efficiency, and added value may also lead to the possibility that a

company creates a sufficient performance with a relative level of efficiency and a relative level of added value. The existence of this solution continuum might explain the findings of Phillips, Chang and Buzell (Phillips, Chang and Buzell, 1983) who found no evidence for the dichotomization offered by Porter.

Given the dynamic resource framework it was chosen to analyse a company on a longitudinal basis and therefore the development along both axes, and not the position, is crucial to categorise a company within one of the defined generic strategies. Following the defined generic strategies the two excluding aspects of exploitation are defined:

Stability in exploitation:

Stability implies that a substantial part of the development of the total operational value of a company can be related to a single generic strategy. The three generic strategies are:

- Efficiency strategy or a continuous reduction of costs per unit turnover.
- Added value strategy or a continuous increase of added value per unit turnover.
- Volume strategy or a continuous increase of turnover without changing the added value per unit turnover or company specific cost-ratio per unit turnover.

Change in exploitation: incremental innovation:

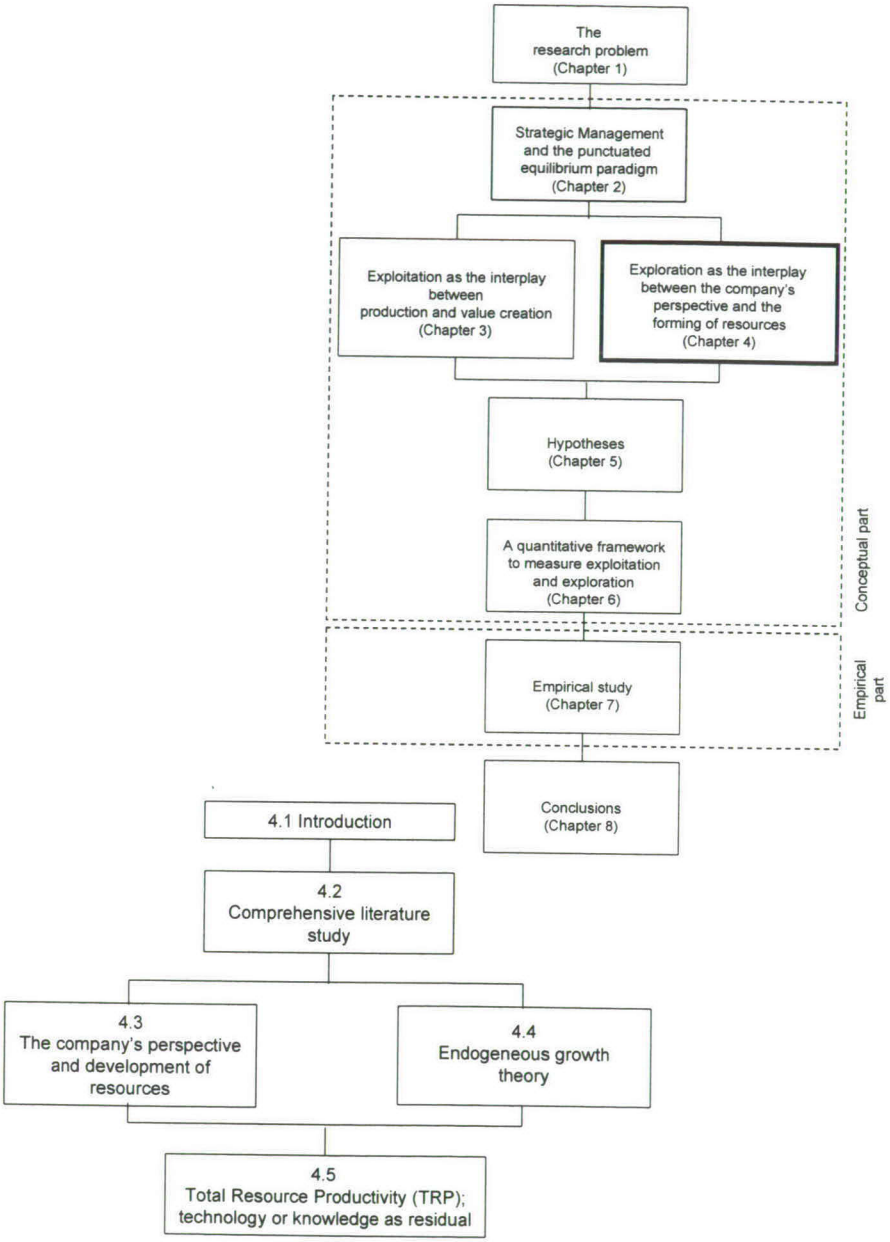
Incremental innovation implies that no one single generic strategy realises a substantial part of the development of the total operational value of a company. Incremental innovation can be the result of a change of deployment from one generic strategy towards a different generic strategy or can be the result of an absence of a generic strategy within the period of analysis. A discontinuity in the deployment of a generic strategy can be the result of explicit or implicit choices by management or by core stakeholders and will affect the process of production and the process of value creation.

According to Porter (Porter, 1996) recent developments in the process of production, such as lean production, business process redesign (Annex C) influence operational effectiveness, but do not actually change the strategy of a company. This finding is consistent with the findings of Chapter two, that incremental innovation implies changes in the process of production but does not change the company's perspective and the process of forming resources. The three generic strategies can be related to the process of production and hence to the configuration of the value chain and to the detected programmes (Annex C) that influence the configuration of the value chain. Based on the literature study presented in Annex C, the detected programmes can be related to the defined generic strategies (Figure 3.3). As a result it can be concluded that the defined generic strategies and hence an operational translation towards individual companies is possible, at least on a conceptual level.

Programme	Goal	Related generic strategies
Just-in-Time (JIT)	Eliminate waste increase productivity	Volume/efficiency
Total Quality Management (TQM)	Improve quality of products and services	Added value
Business Process Re-engineering (BPR)	Overall improvement	Efficiency
Lean Production	Low buffers	Efficiency
Mass Customisation	Provide customised products	Volume/added value

Figure 3.3: Relation between defined programmes and generic strategies

A definition of value is essential to detect stability and incremental innovation within the proposed framework. As previously stated, a definition of value must be related to the process of production or the configuration of the value chain. Within management literature this type of value is frequently financially oriented. Therefore, to detect stability in exploitation or incremental innovation, financial data has been chosen since it can be related to specific developments in the value chain and since financial data is widely available.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4.1 Introduction
4.2 Comprehensive literature study
4.3 The company's perspective and development of resources
4.4 Endogeneous growth theory
4.5 Total Resource Productivity (TRP); technology or knowledge as residual

4. Exploration as the interplay between the company's perspective and the forming of resources

4.1 Introduction

In Chapter two exploration was related to high order or the development of resources within the high order of a company or finding a new high order through radical innovation. Due to the stability of the company's perspective the development of resources is path-dependent and hence stable.

In this chapter the development of resources, especially the development of resources above the input level of the different core stakeholders, in relation to stability and change or radical innovation will be related to endogenous growth theory. From an economic perspective the development of additional production factors above the input factors is defined as Total Factor Productivity, residual value, technology or knowledge. In economic theory a change in the build-up of residual value is a determinant of change of perspective or paradigm. By adapting the Total Factor Productivity (TFP) (see section 4.5) model to companies, the residual value is defined as knowledge or intellectual capital and it will be reasoned that its build-up is also a determinant of change of perspective or paradigm.

4.2 Comprehensive literature study

A comprehensive literature study was carried out in order to find a framework for the relationship between the company's perspective and the development of resources.

By using '*capabilities*' and '*competencies*' as notions related to '*resources*', and '*know-how*' or '*knowledge*' as a determinant of 'resource development', and '*mission*' and '*vision*' as notions related to '*perspective*' and '*management*' as a determinant of '*perspective*', the search primarily focused on meta-studies, literature reviews and empirical studies. Apart from case studies, no literature was found which investigated and analysed the proposed

relationship between resources and the company's perspective or between the related notions and their determinants. The literature which met the criteria provided insight into the vision and growth of companies (Baum et al, 1998) or the structure of companies and the meaning of organisational vision, (Larwood et al, 1995) and the relationship between innovation and strategy (Kaye and Dyason, 1999; Martensen and Dahlgaard, 1999). The literature found did not provide a better understanding of the relationship between the *'company's perspective'* and *'resources'*. Several authors studied the relationship between knowledge and competitive advantage and how companies enhance their competitive position through superior knowledge. Three groups of authors were discovered, all of them dealt with the essential elements or carriers of knowledge i.e. resources (Barney, 1991; Eisenhardt and Schoonhoven, 1996), competencies (Helleloid and Simonin, 1994; Huber, 1991; Fiol and Lyles, 1985; Levitt and March, 1988; Reed and DeFillippi, 1990; van de Ven and Polley, 1992) and capabilities (Kogut and Zander, 1992).

The absence of findings in this area corresponds with the findings of Simonin (Simonin, 1997) who found that many researchers demonstrated the importance of knowledge to management but few have focused on how companies can develop this know-how. Simonin (Simonin, 1997) stated that: '*What has been written is theoretical (Fiol and Lyles, 1985; Huber, 1991; Nonaka and Takeuchi, 1995), and beyond small-sample, in depth studies of a few organisations, there has been almost no empirical work in this area*'. From these findings it must be concluded that the aspects related to the subject of this study are recognised but there is no overall literature or empirical study available which can be used as a framework. Because of the absence of empirical literature, the conceptual relation between the company's perspective and the development of resources will be provided in the next section.

4.3 The company's perspective and development of resources

Both resource-based strategic management and the punctuated equilibrium paradigm stress the importance of learning as an essential aspect in the development of a company's resources. Both theories also state that companies can be classified according to their learning, 'logic of development' and

'routines', which are related to their configuration of technology, organisation and institutionalisation. Radical innovation, double-loop or second-order learning, implies the creation of novel 'techno-economic paradigms' (Dosi, 1984; Dosi et al, 1988; Freeman and Perez, 1989). In neo-classical economics, resources are defined as depletable which differs from the approach of Winter (Winter, 1982; 1988) who stated that resources can be enlarged by *'learning by doing'*. Hirschman (Hirschman, 1985) stated that the actual use of a resource or a skill automatically implies the improvement of the skill or resource; so while resources are scarce they are not simply given but must be developed. Based on an empirical study, Pennings, Barkema and Douma (Pennings et al, 1994) concluded that experience leads to additional know how which creates more capacity to implement future developments more successfully. In a different study Pennings and Harianto (Pennings and Harianto, 1992) concluded that experience was more important than asset investments.

The basic idea of the development of knowledge comes from Adam Smith (Smith, 1776) who stated that division of labour within a company would mean specialisation of skills and hence improved productivity. Development through learning, new resources and knowledge by using company-specific routines is essential in the framework of Winter (Winter, 1982). According to Teece and Pisano (Teece and Pisano, 1994) the process of learning is company-specific and is an instituted process of interpretation, appraisal, trial and feedback. Organisational knowledge interacts with individual knowledge but is more than the sum of the individual parts (Hodgson, 1998). Change can only be studied and analysed by using a non-equilibrium oriented approach to innovation (Hodgson, 1988; Nooteboom, 1992). Future knowledge is by its nature unknown, and the results of research and development as well as the results of *'learning by doing'* are uncertain. Several authors (Arrow, 1962; Kay, 1984; Knight, 1921; Langlois, 1984; Loasby, 1976) pointed out that radical uncertainty provides an answer to the existence of companies. The focus on uncertainty stresses the dynamics of a company, which deviates from equilibrium outcomes. One of the founders of resource-based strategic management, Penrose, found that even within the same industry, the productivity of companies differs enormously (Penrose, 1959). Penrose related company heterogeneity to the process of company-specific knowledge accumulation. Based on studies by Penrose (Penrose, 1959), Eliasson

(Eliasson, 1991), Metcalfe (Metcalfe, 1988) and Nelson (Nelson, 1991; Soete, 1999b), Hodgson (Hodgson, 1998) concluded that an '*emphasis on dynamics and learning in an out of equilibrium context enables a more satisfactory accommodation of the real world fact of firm heterogeneity*'. The development of resources is company specific and is induced by processes such as '*routines*', '*learning by doing*' and other learning processes, such as '*learning by using*' that follow path-dependent trajectories (Arrow, 1962; Dosi, 1988; Pavitt, 1986; Rosenberg, 1982; Soete, 1999b; Teece, 1986; Teece et al 1997). The above authors concluded that an increase in the wealth of a company is merely a process of developing, combining and recombining resources rather than a process of increasing existing resources, which are static or remain 'ex ante'.

The company's perspective implies a specific perception of the environment and as a result, through routines, stabilises the company as a whole and also stabilises the focus on the long-term dominance of the company. From the company's perspective, given the aim of long-term dominance, the company concentrates on combining and recombining resources in such a way that the existing core stakeholders benefit and new resources are developed and operationalised. The build-up of resources is stable when, from the company's perspective, no fundamental changes occur within the firm's basic orientation towards its customers, employees, partners and shareholders. Recombining the existing resources and the development of new resources is intended to increase the productivity of resources and can be achieved by speeding up the learning curve and finding new combinations of resources that fit the company's current perspective. Resource productivity means that more resources can be developed above the input level of the resources provided by the different core stakeholders.

According to Penrose, who implicitly followed the initial thought of Knight on uncertainty (Knight, 1921), a company can be regarded as an organised bundle of competencies which needs a variety of reserves for its operations, whether they be financial, inventory or labour reserves to cope with uncertainty. By arguing that most knowledge cannot be formally taught or communicated in language, it was Penrose who stressed the tacit and elusive nature of skills developed through learning. This learning shows itself in two ways, namely

'*changes in knowledge acquired and change in the ability to use knowledge*' (Penrose, 1959). Slack resources can also be created by developing new resources. The implication of company-specific learning is that an increase of knowledge within the company also provides an opportunity to improve the current production process. The change in developed knowledge can be related to the process of 'learning by doing' while change in the ability to use knowledge is related to the question of 'how to'.

Within the proposed framework the findings of Penrose can be regarded as supportive of the idea that through the development of new resources, the production process can be changed from a company's perspective, which is then defined as incremental innovation. Penrose defined the company as a complex and structured combination of different resources, which combines constraints as well as cumulative development. Using the resource perspective of the company Winter (Winter, 1964) suggested that routines have a relatively durable quality over time to retain skills and other forms of knowledge. Secondly, Winter (Winter, 1971) stated that companies have decision rules and retain or replace them according to the satisfaction principle as defined by Simon, (Simon, 1955) and Cyert and March (Cyert and March, 1963) which states that companies attempt to obtain satisfactory minima, rather than optimise (Hodgson, 1998). The satisfaction principle and its background of '*bounded rationality*' (Simon, 1955) fits in with the path-dependent trajectories of a company. From this perspective stability in exploration is defined as:

> Stability in exploration:
>
> Continuity of the high order or the perspective of a company and hence continuity of the different core stakeholders in relation to the company. A continuity of both the company's perspective and the different core stakeholder result in a longitudinal continuous build-up of total resource productivity.

Unlike a stable build-up of resource productivity, which follows the company's perspective, radical innovation implies a new mental framework or a new

perspective and includes implicit or explicit choices regarding the definition of the business, competencies and other resources. A new perspective results in a change of resources like competencies and positional advantage and in the core stakeholders which deliver elements of these resources. As a result the type, number and combinations of core-stakeholders may change. However radical innovations create different perspectives and will influence the development of competencies and the relationship the company has with its core stakeholders. The difference between incremental and radical innovation can also be affected by the role of knowledge which, besides the learning process, is an essential aspect of the punctuated equilibrium paradigm. In the process of production and value creation, knowledge is developed from the company's perspective, which steers the process of cognition and interpretation. As a result of radical innovation, a new perspective emerges and the same information leads to a different interpretation and results in a different build-up of resources and knowledge. According to Dosi (Dosi, 1982; 1988) technological paradigms or patterns provide a framework for product and process innovations as well as procedures on how to act. The mechanisms of radical innovation, such as the composition of resources and related stakeholders, technological interrelatedness and the strength of competition (Dosi, 1988; Rosenberg, 1976) are those that may lead to economic benefits if they can be recognised by a company. The process of recognition depends on the perspective or the mental framework that the company currently uses and can be regarded as a focusing device (Rosenberg, 1976).

A different perspective implies a different build up of resources. Radical innovation can be measured by measuring the stability of the build-up of resources. Radical innovation implies the creation of novel 'techno-economic paradigms' (Dosi, 1984; Dosi et al, 1988; Freeman and Perez, 1989; Soete 1999b and 1987). From the company's perspective, no fundamental changes occur in the firm's basic orientation towards its core stakeholders. By combining and recombining existing resources new resources are developed which improve the resource productivity. Based on the work of Penrose, Winter, Dosi and Teece, exploration can be related to a stable process of forming resources which is the result of 'learning by doing' or to a different process of cognition and hence to a different build-up of resources and

knowledge. The development of knowledge within the company's perspective is a result of combining and recombining resources. Beyond the company's perspective, different stakeholders may also be identified besides new combinations of new resources. To detect radical innovation, a change in build-up of knowledge or the change in the type of combining and recombining resources should be observed. Radical innovation is therefore defined as:

> Change in exploration: radical innovation:
>
> Change of the high order or a change of the perspective of a company and hence a discontinuity in the importance of the different core stakeholders in relation to the company. A discontinuity of the company's perspective results in a longitudinal discontinuous build-up of the total resource productivity.

From an economic perspective, resources are defined as 'knowledge' or 'surplus' to generate additional value, which is value above the sum of the values delivered by the initial core stakeholders. The difference between ex-post resources and ex-ante resources is defined here as 'knowledge' or 'intellectual capital'. The developed 'surplus' is the result of the company's perspective and its related developed resources. Hence a different perspective will lead to different resources and a change in direction and the level of the 'surplus'. In the process of radical change a new perspective emerges and the company fundamentally changes its view of its resources and related core stakeholders. A different perspective on resources leads to a situation where a different and new positional advantage and different competencies are developed. The result of the full deployment of this new perspective is that the share of the different core stakeholders and their resources as well as the build-up of 'intellectual capital' changes. From an economic perspective, developing 'intellectual capital' is related to theories concerning endogenous growth, which will be discussed in the next section.

4.4 Endogeneous growth theory

According to Adam Smith's theory the division of labour increases the productivity of labour and generates economic growth (Smith, 1776). According to the neo-classical theory growth is driven by exogenous changes in the different factors of production (Ayres, 1998a; 1998b). Later Harrod (Harrod, 1948) stated that besides labour productivity investment is also necessary to permit economic growth, contrary to Smith's theory. As stated by Harrod, the independence of the defined factors of labour and capital is doubtful since the marginal productivity of capital diminishes; if capital grows faster than the labour force, marginal productivity will drop and so will the profitability of the investment. The consequence of the neo-classical equilibrium based on growth is that growth can only be related to an increase in savings or a growth in the labour force. By using only two factors of production (labour and capital) the homogenous Cobb-Douglas function is mathematically convenient on the one hand since it satisfies the Euler theorem but it implies constant returns to scale on the other hand which is considered questionable at least (Ayres, 1998a; 1998b).

Economists like Abramowitz (Abramowitz, 1956) and Solow (Solow, 1957) focused on innovation as the source of continuous productivity increase. They found that the role of investment and labour productivity could not fully explain economic growth and defined residual value as the missing element. From an economic point of view the process of continuously generating surplus in a competitive environment is related to endogenous growth. The denominator of these growth models is the focus on the time paths of output, input and prices (Nelson and Winter, 1974). Starting with the neo-classical model by Solow (Solow, 1957) different authors have developed different models for calculating the surplus or residual value and hence the total factor productivity (TFP). All of them concentrated on the residual value of the economy of nations. Using Q to represent output, and K and L to represent capital and labour, Solow defined the aggregate production function as:

$$4.1 \qquad Q = F(K, L; t)$$

The variable t for time appears in the aggregate production function to allow for technical change or any kind of shift in the production function. In the event that technical change is neutral, the production function takes a special form where A(t) measures the cumulated effect of shifts over time:

$$4.2 \qquad Q = A(t)\, f(K, L)$$

The following equation is obtained by differentiation and division by Q:

$$4.3 \qquad DQ/Q = DA/A + A*Df/DK*DK/Q + A*Df/DL*DL/Q$$

We can now define the relative capital (wk) and the complementary (*equation 4.6*) labour share (wl) and q (*equation 4.7*) and k (*equation 4.8*):

$$4.4 \qquad define: wk = DQ / DK * K/Q$$
$$4.5 \qquad define: wl = DQ/DL * L/Q$$
$$4.6 \qquad default: wk = 1 - wl$$
$$4.7 \qquad define: q = Q/L$$
$$4.8 \qquad define: k = K/L$$

Equation 4.9 can be distilled and transformed into *equation 4.10* which shows that the residual change over time is the same as the change in output per employee minus the change per capital per employee multiplied by the proportion of the capital per output:

$$4.9 \qquad Dq/q = DA/A + wk*Dk/k$$

$$4.10 \qquad DA/A = Dq/q - wk*Dk/k$$

Solow concluded that in the United States during the 1909-1949 the residual value was 87.5%. For the purpose of calculating endogenous growth the neo-classical models used by Solow and others (Solow, 1957; Abramowitz, 1956) defined technology as an exogenous factor. By introducing 'residual' or 'technological progress' as an endogenous factor either the assumption of

constant returns to scale must be abandoned or the unlimited substitutability or constant elasticity of substitution between the factors of production must be modified (Ayres, 1998c). Although from a Schumpeterian perspective a narrow definition of technology should be rejected, the neo-classical models attributed all residual value to technological change.

Further analysis (Jorgonson et al, 1987) emphasised the importance of an effective labour force and an effective stock of capital but technological change remained the most important factor (Grossman and Helpman, 1994). Technological progress requires an intentional investment of resources by profit-seeking companies or entrepreneurs. This perspective defines industrial innovation as the engine of growth (Aghion and Howitt, 1992; Romer, 1990b; 1994c; 1996; Solow, 1994). According to Rosenberg (Rosenberg, 1982) economists have had more success with the consequences of technological change than with its determinants. The endogeneity of technology implies that companies invest in new technologies as an opportunity to earn profits, which has been proven in various studies (Constant, 1980; Dosi, 1984; Freeman, 1982; Rosenberg, 1963) of several industries. As a result the commercial exploitation of scientific ideas not only drives the development and deployment of new technologies but also the focus of scientists since, in the OECD at least, a large proportion of the scientific research carried out is financed by private industry (Nelson and Rosenberg, 1993).

In the growth literature there is no consensus about how technological change should be treated. Authors such as Romer (Romer, 1986; 1990b) and Lucas (Lucas, 1988) extended the neo-classical theory of growth for production externalities which are a consequence of knowledge spillovers experienced in the process of human capital accumulation (Butter, 1996). In recent years the Schumpeterian view of technological change has been revived. These authors stress the dynamic nature of technological and institutional change (Dosi et al, 1988). Here the Schumpeterian view was adopted since this view has many characteristics similar to the neo-institutional school of thought and for the purpose of strategic management it stresses the dynamics of a company. In finding an instrument to detect radical innovation the neo-classical model of Solow was accepted as an appropriate instrument as it is a relative simple

instrument to operationalise. By taking a Schumpeterian perspective, Nelson and Winter (Nelson and Winter, 1974) found similar results.

Baumol (Baumol et al, 1989) found a high correlation between growth in TFP and annual growth rates of capital labour ratios in seven OECD countries in the period 1880-1979. Grossman (Grossman and Helpman, 1994) also found a correlation between growth in TFP and the investment ratios in 22 countries in the period 1970-1988. According to Grossman and Helpman the most probable explanation of why investment rate and growth rate differ is that technology has progressed at a different rate in different countries. The consequence of this explanation is that technological developments attract additional investments (Grossman and Helpman, 1994). From this perspective it is expected that technological development is not just one of the production factors of economic growth but probably the initiator of economic growth. Hence a better definition of '*residual*', '*intellectual capital*' or '*technology*' is essential.

Denison (Denison, 1960, 1962) found that the contributions of tangible labour and capital can be estimated by weighting their rates of change by their shares in national income, so the TFP residual can be partially explained by quantitative indicators of causal forces weighted by their estimated contributions to income and product. By explaining some of the TFP residual by determinants other than '*advances in knowledge*', the level of '*advances in knowledge*', which was initially defined as a factor '*not elsewhere classified*' (nec), becomes clear. Most of the variables measured by Denison reflect the reality that modern economies are in a dynamic moving disequilibrium contrary to the assumptions of production theory. Besides variables like economies of scale and changes in intensity of demand he also found that irregular factors such as weather, strikes and supply shocks have an impact on the development of TFP. This was supported by Madison (Madison, 1987) who found that the oil crises of 1973 and 1979 affected the TFP of the United States. Another variable found by Denison was the positive effect of improved resource allocation. The shift from farming into industry in the United States had a positive impact on the development of TFP. According to Denison the contribution of improved resource allocation disappeared by 1973. For the period up to 1973 Denison found that about half of the development of the TFP

residual for the US was the effect of the rate of increase in scientific and technological factors applied in production. Kendrick (Kendrick, 1961) tried to measure the contribution of advances in knowledge by rates of change in the real reservoir of research & development (R&D). As a result, Kendrick concluded that the rate of diffusion of embodied technologies improved more quickly in other countries than new technologies were developed and deployed in the US. According to Maddison (Maddison, 1987) and Fagerberg (Fagerberg, 1988), this process of '*catching-up*' (Abramovitz, 1990) or convergence would at least partially explain why the residual build-up in the US had been negative since 1973.

From an neo-institutional perspective, productivity advance is a cumulative process of socio-economic and technological change. Economic progress is based on the institutions within society that facilitate or retard productivity advance. In return, technological and economic progress affect these institutions (Nelson, 1997). According to Nelson (Nelson, 1981), the variables in TFP cannot be accurately estimated since the causal forces interact. Historical institutional studies (Dosi, 1988; Dosi et al, 1988; Nelson, 1981; Silverbeg and Soete, 1994) have tried to analyse the role of technological change, structural change and economic development. Developed economies, especially countries in the Western Hemisphere, where most resources are already productive, can only realise growth by focusing on the development of the residual. Like Denison, the OECD and many others have also carried out studies (OECD, 1991) to open the 'black box' of the residual. Studies by the OECD (Sakurai et al, 1996) mainly focused on the apparent contradiction between the perception that technical change has accelerated over the last ten year and the observed fact that productivity growth has not recovered to its post World War II levels (Bell et al, 1991). Analyses of patents, R&D and other factors related to the development of technology and knowledge provide some qualitative but generally superficial answers (Abramowitz, 1991). By extending the neo-classical approach, Romer (Romer, 1986b 1990b; 1993a; 1993b; 1994a; 1994b) and Lucas (Lucas, 1988) as well as Nelson (Nelson, 1981) and Dosi (Dosi, 1988) who followed the neo-Schumpeterian approach (Griliches, 1994), found that the level of productivity is beyond the level of the productivity of the input factors. Both schools of economic thought conclude that the development of technology and innovation play a crucial role in

explaining this productivity gap (Davenport, 1998; Jones and Manuelli, 1997; Silverberg and Soete, 1994). Studies by Denison, (Denison, 1962), Kendrick (Kendrick and Grossman, 1980) and Maddison (Maddison, 1987) provide qualitative answers but do not provide a clear model combining qualitative and quantitative findings (Abramowitz, 1991).

The residual value is defined as the creation of additional output above the level of the different inputs or resources. Countries with a large potential of unused resources are able to grow economically by raising the level of resources relevant to the production process. Countries with limited resources can only grow by increasing their residual. Based on the research by Young, Krugman found that most of the growth of several Asian countries could be explained by the growth of inputs (Krugman, 1994). Krugman argues that growth of the residual was virtually non-existent in the Asian Tigers. According to Solow technical change induces a shift in the development of TFP. By measuring a shift in the development of TFP, the time of operational effectiveness of a new technology can be measured, which is different from the time of the initial investment in new technologies. The recent shift in TFP in the US since 1996 may be explained by the productivity of information technology (The Economist, 1999; Solow, 1999) which differs from Solow's earlier view that *'you can see the computer age everywhere except in productivity statistics'*. It took the US more than twenty years to gain productivity from these investments. Following this line of reasoning implies that a shift in the development of TFP means that a structural shift occurred in the orientation or perspective of the economy as a whole. However it does not state that when the investments were initiated only as a result of these investments and related differences of perspective the build-up of the total factor or resource productivity changes.

When applying the concept of TFP to companies instead of countries this would at least imply that the factors of the model have to be redefined together with the definition of residual. Following the economic concept of the Solow model, the different resources delivered by the core stakeholders would fit as factors related to the initial productivity of a company. In the next section the concept of residual is applied at company level.

4.5 Total Resource Productivity (TRP); technology or knowledge as residual

Many academics have written about the role of technology or knowledge as a factor of increasing importance in the competitiveness of companies, as well as in the relationship between nations and companies (Dosi et al, 1988; Rothwell and Zegveld, 1979; 1981; 1982; Silverberg and Soete, 1994). The 1987 MERIT conference on technical change and economic theory (Dosi et al, 1988) concluded that technological change is essential to the process of economic growth (Dosi et al; 1988). Besides defining the role of technology the authors also recognised that technical change and institutional change are interrelated and require a dynamic adjustment process. From a Schumpeterian point of view, this can be defined as a process of creative accumulation and creative destruction. The proposed framework defines the creation of knowledge and technology, as determinants of the residual, as endogenous, which implies that technology is not just the application of prior scientific knowledge. Rosenberg (Rosenberg, 1976) provided several examples of developments in technology prior to the scientific knowledge and he concluded that growth in knowledge is much more cumulative and interactive than a *'one-shot, once and for all affair'*.

By focusing on institutional change, neo-institutional elements are introduced which have been inherent in the view of Schumpeter (Schumpeter, 1934; 1939) and have been elaborated more recently by Hodgson (Hodgson; 1988). The analysis of technology and economic theory covers a broad spectrum; besides a focus on technology and technological developments, factors like spin-off, technology-transfer as well as cultural aspects and socio-institutional factors, such as willingness to change, are important in the successful development and deployment of new technologies. Following the proposed neo-institutional definition of the company, the path-dependence of a company can be related to the company's perspective and how capabilities are formed. In this sense, developing capabilities is a recursive process where the company's perspective and the successful deployment of current capabilities provide a stimuli for the development of new capabilities. Comparable to Schumpeter, (Schumpeter, 1934); Freeman (Dosi et al, 1988); Nelson (Nelson, 1993) and Hodgson (Hodgson 1988), the successful process of forming capabilities is a process

where besides hard science, social and cultural factors also play a dominant role. Organisational, cultural and other factors within a company, like learning by doing (Rosenberg, 1982), are very important. Combining the process of creation and deployment of innovation results in resources being combined and recombined, and hence knowledge is developed (Lane and Lubatkin, 1998).

Learning from the past through using existing organisational knowledge is defined as organisational memory (Ackerman, 1994; Johnson and Paper, 1998). According to Dosi (Dosi, 1988) for the discovery, experimentation, development, imitation and adoption of new products, the process of innovation requires new production processes and new organisational set-ups. According to Rosenberg (Rosenberg, 1969) companies are frequently inevitably pushed in a certain direction to search or develop, which he called the '*technological imperative*'. As a result, technological discontinuities may '*blow path dependencies asunder*' (Teece, 1988) and will affect the company's perspective and process of forming resources. The process of forming resources from the company's perspective and the impact of technological discontinuities on the company's process of forming resources follows the Schumpeterian innovation theory with its emphasis on the processes of creative destruction and creative accumulation. These findings about resources follow the definition of capabilities as company-specific combinations of resources related to organisational, functional and technological skills (Teece et al, 1997).

The development of the original resources can be measured by measuring the productivity of the different resources. TFP measurements must be seen as an instrument to detect how well society allocates its scarce resources. The broadening of TFP to TRP (Total Resource Productivity) is self-evident (Gollop and Swinand, 1998); TRP, as compared with the Solow model, may provide insight into how well a company allocates and exploits its resources by developing its company residual. Complementary to the economic definition of residual value, residual value also needs to be defined at company level. The build-up in the residual value at company level also provides insight into the level of productivity of the interplay between the different resources. By taking a broad definition, the productivity of the interplay between resources can be defined as technology. According to Dosi (Dosi, 1988) and Zack (Zack, 1999),

in each technology there are elements of tacit and explicit knowledge (Polanyi, 1966) that cannot be written down in a blueprint form and, as a result, can not be diffused and are company-specific.

Most studies on company-specific innovation focus on technological innovations. As stated earlier from a TFP point of view technological innovations are defined too narrowly since organisational and other factors may also have a major impact on the development of a company's TRP. No data, analysis or experiences were found on the development and analysis of the TFP or TRP of individual companies; only studies that focused on an industry-level or on the relationship between determinants of TFP such as R&D and company performance (Griliches, 1988; 1998) were found. Therefore, a more general analysis of the productivity frontier of a company has been provided. Roach (Roach, 1996) tried to bridge the gap between productivity on a national scale and productivity on a company scale by analysing the impact of productivity changes in American companies.

According to Roach, the focus of most American companies is '*instead of focusing on investment in innovation and human capital – the heavy lifting required to boost long term productivity – corporate strategies have become more and more focused on downsizing and compressing labor costs*' (Roach, 1996). According to Roach the continuous focus on downsizing as an instrument to compete on efficiency results in a decreasing level of investment in new trajectories and as a result in a decreasing marketshare. The MIT Commission on Industrial Productivity concluded (Dertouzos et al, 1989) that American companies may regain their productivity edge through an integration of resources and new technological developments. Interestingly, the co-chairman of the commission was Solow. The commission found that certain industries play a crucial role in the long-term growth of national productivity because of their potential for generating technological spillovers or because other industries depend on them. These sectors may have little effect on the current American productivity statistics but may make a disproportionate contribution to long term productivity growth. Besides the short time horizons of companies and their technological weaknesses in development and production, the under-valuation of human resources and failures of cooperation were also considered to be the main sources of the slowdown in American

productivity in the 80s. It is also expected that the problem of productivity slowdown has to do with an interaction between the different factors as much as any single factor.

According to economic theory a discontinuity in the residual build-up at company level should be interpreted as a shift in the deployment of 'technology' or 'knowledge'. Given the neo-institutional perspective of this thesis 'productive technology' or 'knowledge' should be seen from a broad perspective. A radical shift in the development of the residual build-up implies a more radical impact due to the deployment of new knowledge or new technologies and can be defined as a radical innovation. The finding that technology is paradigm bound is consistent with the findings of Kuznets (Kuznets, 1930). Following Schumpeter, 'technology' or 'knowledge' in this sense is defined here as a radical innovation. This follows the resource-based view of the company which states that innovation is about '*new combinations of resources*' (Penrose, 1959; Black and Lynch, 1996; Mahoney, 1992). New knowledge and hence the successful deployment of this knowledge as a form of combining resources and the leverage of this process may be the result of explicit or implicit developments (Jenner, 1998).

Only new combinations of resources that conceptually differ from existing combinations will result in a shift at the level of productivity that cannot be traced to one of the core stakeholders. Different combinations of resources will change the company's mind in such a way that different capabilities are developed (Bowman et al, 1999). The continuous process of innovation implies that knowledge is not only the output of the innovation process but is also a resource to be used in the next cycle of the process of production (Zack, 1998). As a result, from the company's perspective, knowledge can be leveraged (Arend 1999). The focus on leveraging a company's resources is one of the major elements in the work of Hamel and Prahalad (Hamel and Prahalad, 1993). However they do not use the term '*productivity*', the proposed '*arena of resource leverage*' (Hamel and Prahalad, 1993) is directly related to a productivity increase of the company's resources and the company as a whole. Several of the leverage processes detected by Hamel and Prahalad are directly related to productivity development as defined above, but on an national scale:

- The process of accumulation is oriented towards organisational learning and learning within alliances and joint ventures. According to Hamel and Prahalad (Hamel and Prahalad, 1994), accumulating resources does not just imply that more resources should be employed but also that the organisation of the current resources and the process of learning between resources should be more effective (Ayres, 1998c). This notion can be related to the concept of Denison (Denison, 1960, 1962) on improved resource allocation and the notion of the MIT commission (Dertouzos et al, 1989) related to the under-valuation of resources and the necessity for cooperation.

- The process of complementing resources is concerned with the development of new technologies to multiply the effectiveness of the resources. This concept can be related to the notion of Romer (Romer, 1990b) on the development of technology and the notion of the MIT commission (Dertouzos et al, 1989) related to the technological weaknesses of American companies.

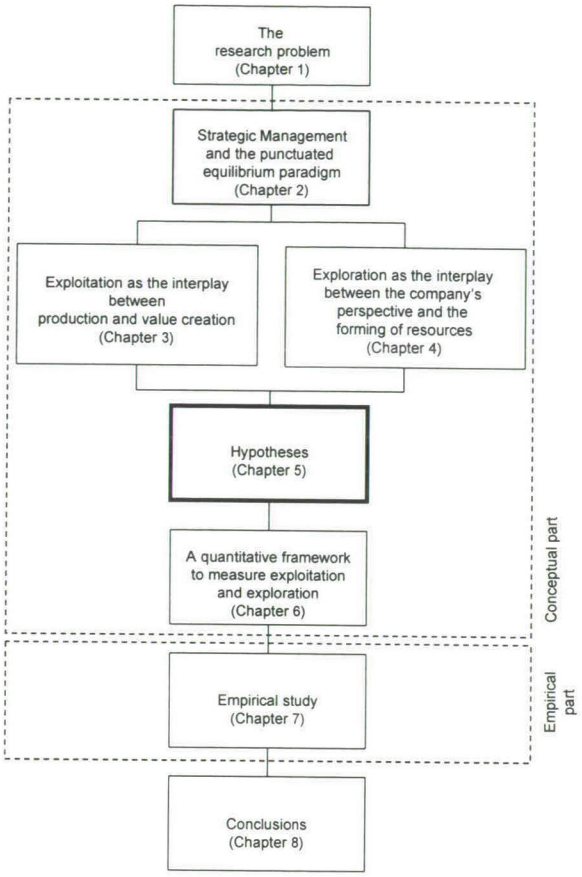
- Representing the resource-based management school, Hamel and Prahalad stated that communicating the company's perspective and concentrating the resources around this perspective will increase the leverage of the resources (Noda and Bower, 1996). The process of recycling and the recovering of resources focus on multiplying the deployment of successful technologies and increasing the frequency with which a successful technology can be deployed (Engelbrecht, 1997; Lang et al, 1996).

The previously defined relationship between TFP, innovation and technology can be translated into company-specific innovation and the creation of knowledge within the company. A change in the process of forming capabilities implies a change in the creation and deployment of new knowledge or innovations, which is much broader than the development of technologies, since implementation and organisation aspects are crucial factors. In this sense, Schumpeterian serendipity becomes reality. In this sense, the development of new knowledge, new experiences and new assets can be related to the process of creating surplus or residual value.

Given this scope, residual value is defined as 'intellectual capital' or '*organisational capital*' (Levinthal, 1991), because it increases the leverage of the input of the core stakeholders and cannot be attached to one of the core stakeholders. In this sense 'intellectual capital' is company-specific knowledge which is developed by combining and recombining resources. A conference on measuring intellectual capital organised by the OECD (Bornemann et al, 1999; Leadbeater, 1999), however concluded that there was an absence of generally accepted instruments. The working papers presented a wide variety of possible instruments.

Three approaches were proposed to measure intellectual capital: the difference between the market value and book value (Megna and Klock, 1993; Mouritsen, 1998); the sum of the impact of the core competencies on the value and future value of a company; and the use of the balance scorecards methodology. Unlike the first two groups of instruments, the last one does not provide an integrated approach. By using the market value of a company as a denominator, intellectual capital is as volatile as the stock market and no clear conclusion can be drawn about the endogenous component of knowledge. However, this disadvantage can be overcome by using the theoretical option pricing theory (Leslie and Michaels, 1997). The second group focused on the quantification of core competencies. This method follows the resource perspective of a company. Under this method core competencies must be defined and the impact on the actual value of the company must be calculated per core competence. This assumes that the core competencies can be defined and analysed in terms of value. Following the proposed framework of generic firm processes the second assumption should at least be questioned. Even if this was possible, it assumes the existence of a linear relationship between the defined core competencies and the value of a company. This is probably incorrect: the combination of three core competencies will have a higher impact on the value of a company than the sum of the three core competencies. Therefore, within the framework of this study the proposed methods have to be abandoned. Companies that define knowledge as a strategic resource, with the aim of providing additional value to their core stakeholders opt for a sustainable competitive advantage because the more a company already knows, the more it can learn (Zack, 1999).

Thus, companies should experiment and learn in areas that potentially add value to their existing knowledge. From the company's perspective, long term dominance or success requires a dynamic aligning of knowledge and resources. On a metalevel the capability to accumulate knowledge from its routines and experiences and reapply of this knowledge is a competence in itself and may also provide a major strategic advantage (de Geus, 1997).


The
research problem
(Chapter 1)
Strategic Management
and the punctuated
equilibrium paradigm
(Chapter 2)
Exploitation as the interplay
between
production and value creation
(Chapter 3)
Exploration as the interplay
between the company's
perspective and the
forming of resources
(Chapter 4)
Hypotheses
(Chapter 5)
A quantitative framework
to measure exploitation
and exploration
(Chapter 6)
Empirical study
(Chapter 7)
Conclusions
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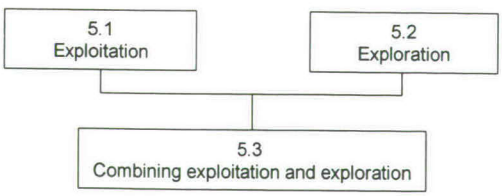

5.1
Exploitation
5.2
Exploration
5.3
Combining exploitation and exploration

5. Hypotheses

The exploitation – exploration dilemma is generally recognised within management science (Arrow, 1962; Cyert and March, 1963; Hannan and Freeman, 1987; Hey, 1982; Levinthal and March, 1981; 1993; Radner and Rothschild, 1975; Simon, 1955; Varela, 1991; Winter, 1971) as a relevant dilemma stating that companies should simultaneously exploit current short-term certainties and explore new and long-term opportunities. This dilemma addresses specific questions about the current deployment, vision and developments of the content and processes of interactions between the company and its core stakeholders. Therefore the exploitation – exploration dilemma can be positioned within strategic management. No studies have been found that defined the dilemma within a qualitative and quantitative framework, which implies that it is currently unknown from this perspective if and how companies find a balance within the dilemma or how companies are '*competing today and preparing for tomorrow*' (Abell, 1999).

Although the punctuated equilibrium paradigm, with its background in social, physical science disciplines, including biology (Gould, 1989), sociology (Kuhn, 1970) and psychology (Levinson, 1986) does not analyse the exploitation – exploration dilemma, it does provide a qualitative and quantitative framework that measures incremental and radical change. The interplay between exploitation and exploration stresses aspects of company-specific learning or the epistemic capability of companies (Brown and Duguid, 1991; Kim, 1994; Nooteboom, 1999b) which is the result of a configuration of technology and related organisation based on the implicit or explicit vision, norms and values of a company. Given this, strategic management can be defined as the interplay of adaptability and learning within the company's vision and fundamental change of the company's vision. These two aspects of strategic management form the heart of the punctuated equilibrium paradigm (Gersick, 1988, 1989, 1991; Miller and Friessen, 1980; 1984; Romanelli & Tushman, 1994; Tushman and O'Reilly III, 1996; Tushman and Romanelli, 1985).

The punctuated equilibrium paradigm is about adaptation on two levels, i.e. within the company's vision with a focus on exploitation and alignment, and beyond the company's vision with a focus on exploration and experimentation. Therefore the punctuated equilibrium paradigm is chosen to determine how a company behaves within the exploitation – exploration dilemma. However, it will require some adjustment.

The punctuated equilibrium paradigm concentrates on identifying the vision or perspective of a company, also defined as 'high order', which lies at the heart of periods of relative stability. According to Gersick (Gersick, 1991), high order is a set of coherent interdependent implicit and explicit choices which form the basic configuration into which a system is organised. The existence of high order is essential to stabilise and optimise the company on the one hand but may imply organisational inertia on the other. According to Gersick (Gersick, 1988), high order is based on a framework that forms a stable platform from which a company operates. High order implies stability but does not mean acceptance that the environment and the company are static (Romanelli and Tushman, 1986). During periods of high order the company is active in maintaining and carrying out choices based on high order. During incremental change the existing high order remains intact. Under the process of radical change the high order must be dismantled before a new high order can be found. Dismantling the high order of a firm means that the company is temporarily disorganised, only to form a configuration that operates according to a new set of rules.

Apart from the distinction between exploitation and exploration, as one of the distinctions made in theories of corporate change, other distinctions include first-order versus second-order learning (Fiol and Lyles, 1985; Hedberg et al, 1976) and single-loop versus double-loop learning (Argyris and Schon, 1978). The difference between incremental and radical change can also be related to first-order versus second-order learning (Fiol and Lyles, 1985; Hedberg et al, 1976) and single-loop versus double-loop learning (Argyris and Schon, 1978; Romme and Dille, 1997). The existence of path-dependencies and the two types of learning implies a distinction between the creation of novel 'techno-economic paradigms' and the movement along these 'technical trajectories' based on such paradigms (Dosi, 1984; Dosi et al., 1988; Freeman and Perez,

1989). Learning can be best understood by using the 'resource' (Penrose, 1959) or the 'competence' view of the firm (Nooteboom, 1999b) since learning stresses the ability of the firm to induce new activities as a result of new information, new visions or new experiences. Based on the analysis on generic firm processes, the stakeholder approach and aspects of learning, provided in Chapter two, it is concluded that the resource perspective encompasses the punctuated equilibrium paradigm. The dynamic resource perspective selected in Chapter two stresses the need to develop, innovate and learn, and analyses the role of a single company in its environment, which makes the contractual theory of the firm applicable (Nooteboom, 1999c; Peteraf, 1992; Pitelis, and Pseiridis, 1999; Silverman 1999; Slater, 1997). The operationalisation of the resource perspective, and thus the competence approach developed by Prahalad and Hamel (Prahalad and Hamel, 1989; 1990; 1991), mainly focuses on the relationship between competence development and the perspective of the company which means that competition has to be defined more accurately. In the stakeholder approach scarcity creates competition, which implies that competition is not only related to winning customers and their buying power but is also related to winning employees, partners and shareholders. A balance has to be found depending on the level of scarcity of the different core stakeholders, the content of the generic firm processes and the inputs provided by the core stakeholders. In this perspective, competition is defined as a multi-layered process. Exchanges between the core stakeholders and the different levels of scarcity between the core stakeholders generate competition at the firm level. Competition can also be discerned between a company and its environment, which focuses on keeping and gaining relevant core stakeholders. This implies that competition is not industry-specific and may have a deep and broad impact on the structure and behaviour of a single company.

Inherent to their quantitative model Romanelli and Tushman (Romanelli and Tushman, 1994) defined change as incremental or as radical. By using different parameters for incremental and radical change a company is caught between two opposing poles of optimisation: long term dominance versus short-term profits or cash flow. Different generic firm processes focus on developments related to incremental or radical change but are intertwined because the different generic processes are parts of the same single company. According to March (March, 1991) combining and balancing exploration and

exploitation is essential. Contrary to the current use of the punctuated equilibrium paradigm, it is found necessary that the proposed framework provides the ability to measure incremental and radical changes not only alternately but also simultaneously and thus measures the balance between exploitation and exploration.

Incremental innovation is implicitly influenced or explicitly steered by the company's vision or perspective. As a result it is assumed that within the company's perspective the process of resource build-up is stable. To mark the difference between incremental change as defined by Tushman and Romanelli (Tushman and Romanelli, 1985) and the definition of incremental change proposed here, the latter will be defined as incremental innovation. Incremental innovation is about aligning fit to strategy, culture and processes and is directly related to the process of value creation and the process of production. Since high order is related to radical innovation, incremental innovation may occur within one specific perspective, with the result that the time frame for optimising the production process and the value creation process is much shorter than the horizon for optimising the company's perspective.

Radical innovation is defined as Schumpeterian novel combinations and implies a shift from the existing path and related path-dependent trajectories and results in a new perspective of the company. A new combination of resources will result in a different productivity of the resources and can be realised by speeding up the learning curve, finding new combinations of resources that fit the current company's perspective by increasing the level of knowledge based on new developments and experiences. A new perspective will result in a change of resources like competencies and positional advantages as well as in a change of core stakeholders.

In Chapter two the relation between exploitation and exploration was presented not only through the use of the punctuated equilibrium paradigm but also by using the stakeholder approach and generic firm processes. Based on the analysis presented in Chapter two it is concluded that an adjusted punctuated equilibrium framework provides a conceptual framework to analyse the exploration – exploitation dilemma. The qualitative adjustments of the relation between exploitation and incremental innovation were presented in Chapter

three and the adjustments of the relation between exploration and radical innovation was presented in Chapter four. In Figure 5.1 a nomological network of antecedents and consequences of the exploitation – exploration dilemma is presented.

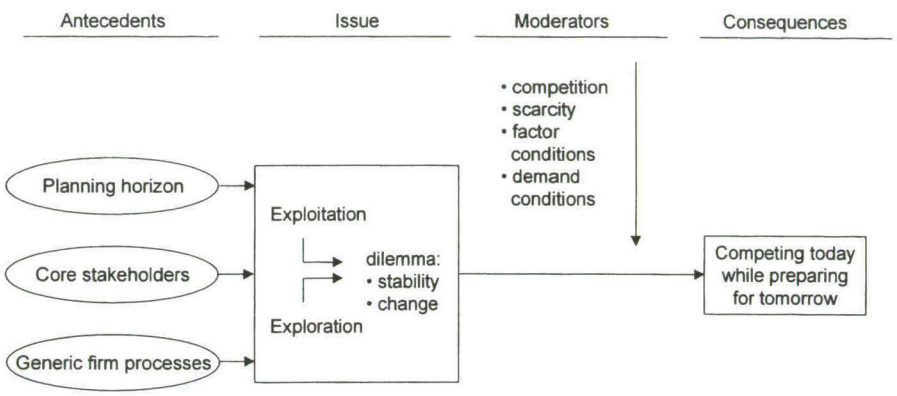


Figure 5.1: Nomological network of antecedents and consequences of the exploitation – exploration dilemma

Given these findings the remaining three research questions, all three addressing aspects of the exploitation – exploration dilemma, will be transformed into eight hypotheses. In the first chapter it was concluded that the defined research questions are contradictory, since it was assumed that stability in exploration would maximise exploitation and that radical innovation provides new opportunities, which may result in higher levels of exploitation. These contradicting assumptions will be tested empirically using the hypotheses formulated in the next two paragraphs.

5.1 Exploitation

A definition of stability in exploitation and incremental innovation is essential to detect stability or incremental innovation. Optimising the process of production and value creation has to do with aligning or 'fitting the organisation' and can be achieved within the boundaries of the company's perspective. In Chapter two it was concluded that exploitation uses a short time frame to optimise the production process and the value creation process. In

Chapter three both stability and incremental innovation, which are two excluding aspects of exploitation, were defined by using the concept of the value chain. The concept of the value chain and hence value chain analysis was chosen since this concept is a generally accepted method to analyse the production process in relation to the value creation process. Based on the short-term optimisation criteria in relation to the process of value creation, a financial orientation of the optimisation parameter is chosen. However, contrary to Porter, the chosen resource perspective does not primarily focus on competitors or industry groups to judge a company's position. As a result a specific focus or the generic configuration of the value chain is related to the success of the company itself and thus related to profits or cash flow as the financial variable to determine the development of exploitation on the company level. Stability in exploitation can be related to the longitudinal deployment of a specific generic strategy. Several authors generated generic strategies (Buzell et al, 1975; Porter, 1980; Utterback and Abernathy, 1975) or studied the existence and relevance of generic strategies (Dess and Davis, 1984; Galbraith and Schendel, 1983; Hall, 1980; Hambrick, 1983; Karnani, 1984; White, 1986; Wright, 1987).

Strategies in general can only be relevant when the outcome of these strategies differ and when commitment is essential to gain an advantage (Ghemawat, 1991). Most of these studies are qualitative or concluded the existence of generic strategies on a product or SBU-level. Apart from the study by Karnani (Karnani, 1984) no studies were found that used financial analyses to conclude if a company deploys a specific generic strategy. Karnani (Karnani, 1984) translated two Porterian generic strategies into a quantitative model based on financial variables. As a result of this analysis three generic strategies were identified, all based on how a company develops its operational value: by turnover growth (volume), cost reduction (efficiency) or increasing added value (added value). The interrelationships between the different generic strategies were recognised by Karnani (Karnani, 1984), who stated that a generic strategy can be represented on a continuum. Due to the existence of the defined continuum the detection of the deployment of a generic strategy can only be related on a longitudinal basis.

Following the defined generic strategies both stability and incremental innovation, as the two excluding aspects of exploitation, were defined in Chapter three. Stability implies that a substantial part of the development of the total operational value of a company can be related to a single generic strategy. Incremental innovation implies that no single generic strategy realises a substantial part of the development of the total operational value of a company.

Generic strategies and thus stability in exploitation are only relevant if pursuing a single generic strategy creates a higher value than switching between different generic strategies. Following this line of reasoning, the concept of commitment (Ghemawat, 1991) is useful and results in the following hypothesis:

> *Hypothesis 1:*
> *In exploitation successful companies are consistent in the selection and deployment of a generic strategy.*

According to Porter (Porter, 1998), Western markets are saturated which means that a one-dimensional low-cost focus is not sustainable as long as only one company can be cheapest. According to Porter competition on premium value, which is multi-dimensional, allows companies to focus on aspects like service, speed, quality, security, etc., is the ultimate strategy for companies in the Western Hemisphere. Within a single market different companies will act based on different propositions. The following hypothesis can be added:

> *Hypothesis 2:*
> *Companies that follow an added value strategy will be more successful in exploitation than companies that follow an efficiency or volume strategy.*

The configuration of the value chain changes continuously, not only as the result of portfolio changes but also as the result of operational changes such as the development of new products and services, cost reduction programmes and programmes that focus on operational effectiveness in general.

Within the last twenty years several programmes, such as Just-in-Time Total Quality Management, Business Process Re-engineering, Lean Production and Mass customisation (Annex C), were developed and implemented and had a direct impact on the configuration of the value chain and can related to the defined three generic strategies.

If generic strategies are indeed worthwhile (Ghemawat, 1991) and these strategies can be placed on a continuum (Karnani, 1984) then the Porter-dilemma does not have to exist as an exclusive dilemma but may be available on a more subtle level. Given the scarcity of core stakeholders and resources it is assumed that a deployment of an added value strategy will have a negative impact on the development of the efficiency of a company and vice versa. This leads to the following hypothesis:

> *Hypothesis 3:*
> *An added value strategy will lead to adverse developments in efficiency and vice versa. This is generally known as the Porter-dilemma.*

5.2 Exploration

Exploration is related to high order or the development of resources within the high order of a company or finding a new high order through radical innovation. Due to the stability of the company's perspective the development of resources is path-dependent and hence stable. No studies were found that both qualitatively and quantitatively related the development of resources to the perspective or high order of a company. Most of the studies were qualitative and focused on essential elements or carriers of knowledge i.e. resources (Barney, 1991; Eisenhardt and Schoonhoven, 1996), competencies (Helleloid and Simonin, 1994; Huber, 1991; Fiol and Lyles, 1985; Levitt and March, 1988; Reed and DeFillippi, 1990; van de Ven and Polley, 1992) and capabilities (Kogut and Zander, 1992). Due to the absence of studies within management science on the development of resources, this study focuses on the development of resources in relation to endogenous growth theory, which uses an economic angle and analyses the development of resources in relation to the perspective of an economic entity.

From an economic perspective the development of additional production factors above the input factors is defined as Total Factor Productivity, residual value, technology or knowledge. In economic theory a change in the build-up of residual value is a determinant of change of perspective or paradigm. By adapting the Total Factor Productivity (TFP) model to companies the residual value is defined as knowledge or intellectual capital and it will be argued that its build-up is also a determinant of change of perspective or paradigm.

The company's perspective implies a specific perception about the environment and as a result, through routines, stabilises the company as a whole and focuses on the long-term dominance of the company. From the company's perspective, with the aim of long-term dominance, the company concentrates on combining and recombining resources in such a way that the existing core stakeholders benefit and new resources are developed and operationalised. The build-up of resources is stable when, from the company's perspective, no fundamental changes occur within the firm's basic orientation towards its customers, employees, partners and shareholders. Recombining the existing resources and the development of new resources is intended to increase the productivity of resources and can be achieved by speeding up the learning curve and finding new combinations of resources that fit the company's current perspective. Resource productivity means that more resources can be developed above the input level of the resources provided by the different core stakeholders. Resource productivity can be measured by the total resource productivity of a company. Total resource productivity cannot be allocated to an increase in productivity by any of the core stakeholders. Total resource productivity is hence defined as the company-specific leverage available to increase the productivity of its resources.

The mutually exclusive aspects of exploration, stability and radical innovation are related to the development of resources. Stability is defined as a continuity of the high order or the perspective of a company and hence continuity of the different core stakeholders in relation to the company. Given Austrian economics it is expected that residual value will decrease over time. However, due to changes within a generic strategy it is expected that residual value will increase over time.

Combining the two arguments, it is assumed that within the company's perspective, the total resource productivity is stable.

Radical innovation implies a shift away from the existing path and related path-dependent trajectories and results in a new perspective for the company and has a direct impact on the process of forming resources and is defined as second-order learning. A new perspective will result in a change of resources such as competencies and positional advantages and, as a result, in the core stakeholders and combination of core stakeholders which create these resources.

Radical innovation is defined as innovation which has a direct and major impact on the company's perspective and the process of forming resources. The process of forming resources is directly related to the different core stakeholders, the resources they deliver and the resource productivity of the company. As a result radical innovation will have an impact on the relationship between the resources and the different groups of core stakeholders that create these resources. Radical innovation changes the configuration of the resources and the related core stakeholders, which results in a shift in the total resource productivity of the firm.

Following Austrian economics it is expected that over a relatively long period of time incremental innovations will be insufficient to survive. Competitive pressure will reduce the strength of the company's perspective over time. It is likely that the total resource productivity of companies with a stable perspective will be stable or will decrease as a result of competitive forces. Only radical innovation will ensure that a company can survive the impact of these competitive forces. Again, following Austrian economics, it is expected that the strength of the perspective will diminish over time. Within a limited time frame this can be resolved by incremental innovation. However, at a certain point in time incremental innovation is insufficient to be able to survive and radical innovation becomes essential. From the company's perspective the residual build-up or the process of forming resources remains stable. Radical innovation is a rare phenomenon, which means that in most companies the build-up in residual value is relatively stable:

Hypothesis 4:
Radical innovation is a rare phenomenon and implies that in most companies the build-up of total resource productivity is stable.

A different perspective will lead to a different process of forming resources and hence a different build-up in the company's resource productivity. This process is defined as radical innovation.

Radical innovation is expected to be rare and implies a change in perspective and a change in the combination of resources and core stakeholders. As a result it is expected that in relatively young or dynamic industries (service industry rather than physical production) the likelihood that the perspective will change is higher than in mature industries. This leads to the following hypothesis:

Hypothesis 5:
Radical innovation occurs more frequently in the service industries than in the physical production industries.

Besides the industrial sector, size is also expected to be a determinant in radical innovation. As radical innovation is defined as a high order change the firm processes and core stakeholders are more likely to be more institutionalised and distributed over divisions or countries. This leads to the following hypothesis:

Hypothesis 6:
Radical innovation occurs more frequently in small companies than in multinational or multidivisional companies.

5.3 Combining exploitation and exploration

Radical innovation and incremental innovation are interrelated since the perspective of a company drives both incremental innovation and radical innovation. Given the relationship between radical and incremental innovation incremental innovation can occur without changing the company's perspective.

This leads to the following hypothesis:

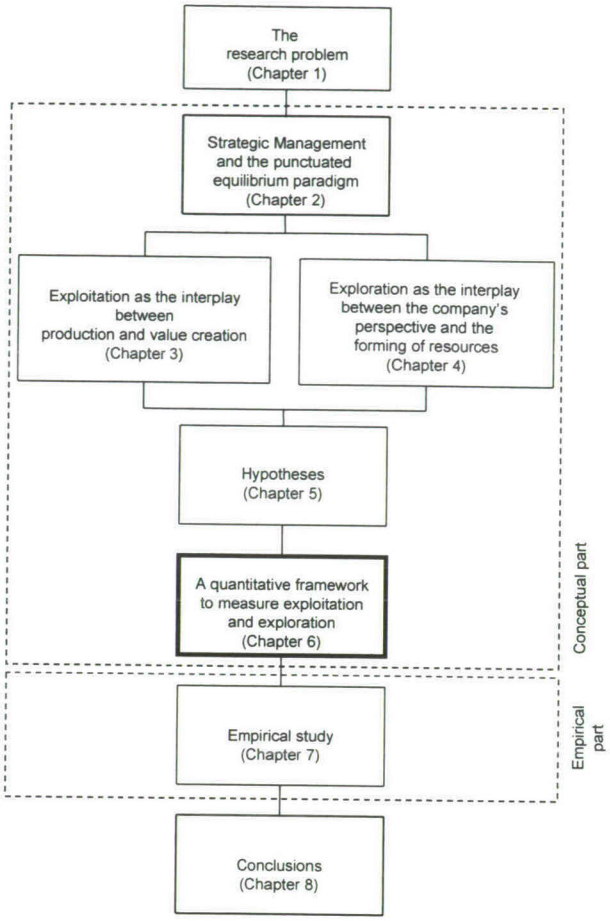
> *Hypothesis 7:*
> *Incremental innovation occurs at least twice as often as radical innovation.*

By determining the residual build-up as intellectual capital, the actual deployment of the process of forming resources based on the company's perspective can be measured. This implies that when a sudden change in the company's total resource productivity occurs it probably does not indicate the initial period that a company is active in forming a new perspective and forming new resources related to this perspective, but just the demonstrable measurable result of effective deployment of the new resources. A sudden shift in the productivity of resources does not reflect the implicit or explicit desire for radical innovation but radical innovation itself. The process of forming resources, as measured by the build-up of residual, is assumed to be relatively stable in most companies. It is also assumed that the build-up is positive due to the strength of the company's perspective and its developed and deployed capabilities. Companies with a negative build-up, in other words a tear-down, of their resource productivity have a weakened perspective or are unable to translate their perspective into relevant and useful resources. The surplus of resources, which cannot be related to one of the core stakeholders may lead to a further development of exploitation. This produces to the following hypothesis:

> *Hypothesis 8:*
> *Radical innovation increases the development of operational cash flow when this radical innovation is the result of a build-up in residual value and reduces residual value when the radical innovation results in a reduction in the development of operational cash flow.*

According to this last hypothesis radical innovation does has an impact on the development of the exploitation research which was addressed in the last research question.

Hypothesis 8 can be related to the findings of Collins and Porras (Collins and Porras, 1994) who showed that companies with a clear perspective financially outperform companies that do not have a clear perspective or vision and only focus on financial value creation. Hence hypothesis 8 should be viewed as a validation of the proposed framework.


The
research problem
(Chapter 1)
Strategic Management
and the punctuated
equilibrium paradigm
(Chapter 2)
Exploitation as the interplay
between
production and value creation
(Chapter 3)
Exploration as the interplay
between the company's
perspective and the
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(Chapter 4)
Hypotheses
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A quantitative framework
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and exploration
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Empirical study
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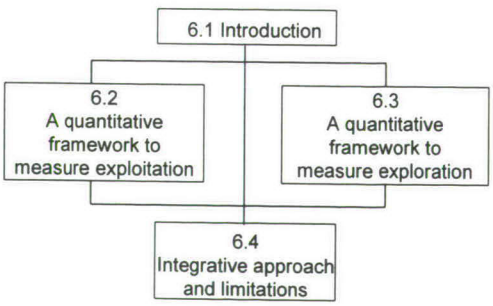
Conclusions
(Chapter 8)
Conceptual part
Empirical part


6.1 Introduction
6.2
A quantitative
framework to
measure exploitation
6.3
A quantitative
framework to
measure exploration
6.4
Integrative approach
and limitations

6. A quantitative framework to measure exploitation and exploration

6.1 Introduction

Generic firm processes, the stakeholder approach and their link with exploitation and exploration were introduced in Chapter two. It was stated that the alignment of fit between strategy, culture and process is the key to exploitation. This alignment is a process of first-order learning and limited by the company's perspective and the routine of forming resources. The company is defined as a hierarchy of processes all influencing each other and their environment, and themselves influenced by their environment. The hierarchy of processes follows the dynamic resource view, which implies that the company's perspective and the process of forming resources form the high order of a company. The defined core stakeholders are linked in such a way that both the company and the different core stakeholders benefit. The process of production and value creation and hence exploitation is only fruitful through the use of company specific resources. Simultaneously, the company's perspective and the process of forming resources and hence exploration, can only be deployed through the process of production and value creation. Due to the interdependence of the different processes the company as a single entity is defined as the unit of analysis.

So far the analysis and discussion of the origins of exploitation and exploration has been purely academic and theoretical. In this Chapter the conceptual frameworks are translated into quantitative frameworks to detect stability in exploitation or incremental innovation and stability in exploration or radical innovation. Besides the limitations or boundaries of these frameworks this Chapter will conclude with an integrated framework to detect stability and change on both exploitation and exploration.

Exploitation and exploration, as described in Chapters three and four respectively, can be summarised by using three axes, i.e. their focus, background and typology (Figure 6.1).

Axis	Determinant	Exploitation	Exploration
Focus	Goal Planning horizon Orientation	Financial value creation Short term Combining process of production with value creation	Long term dominance Long term Combining company's perspective with forming resources
Background	Theoretical background Author Framework for analysis Operationalisation	Generic strategies Porter; Karnani Value chain analysis JIT, BPR, TQM, LP, MC	Endogenous growth theory Solow; Griliches Total Resource Productivity Mission, Vision
Typology	Stability Change	Generic strategies are stable Change of generic strategy or incremental innovation	Build-up of TRP is stable Shift in build-up of TRP or radical innovation

Figure 6.1: Summary of exploitation and exploration

In Chapter two it was stated that the punctuated equilibrium paradigm provides a conceptual framework in which the exploitation – exploration dilemma can be analysed. The punctuated equilibrium paradigm is best positioned as part of dynamic resource perspective can, through the use of generic firm processes and the stakeholder approach. The paradigm is exclusive, only the existence of either incremental or radical change can be measured, and thus it has to be altered. Secondly, the paradigm strictly focuses on change, which means that the only definition of stability is related to high order stability which, within the punctuated equilibrium paradigm, is identical to incremental change. In Chapter two incremental change is related to a change of scope on the process of production and value creation and radical change is defined as a change of scope on the process of forming resources and the perspective of the company. The word 'change' however, has a non-economic connotation which differs from the exploitation – exploration dilemma that aims to measure the actual result of the behaviour of the company related to the deployment of the company's perspective and the process of value creation. Therefore, for this purpose, 'change' is altered to 'innovation' since innovation is defined as the actual economic impact of new developments (Chapter two).

On a conceptual level it was concluded in Chapter four that within the company's perspective no major shifts on scarcity or dominance occur between

the core stakeholders of the company and the resources that are developed as a result of the inputs of the combinations of the different core stakeholders. A change of perspective or a radical innovation implies that existing resources are recombined and new resources are developed. Through the use of economic growth theory the longitudinal development of resources can be analysed on aspects of stability and change. Thus that both mutually exclusive aspects of exploration (radical innovation and stability in exploration) can be detected. Within the company's high order or perspective the existing resources are configured in such a way that the process of production leads to financial value creation. In Chapter three generic strategies were used to define stability and change in exploitation. A change of generic strategy is related to a change of scope in the production process and the financial value creation process and is referred to as incremental innovation. Incremental innovation may be induced by external or internal developments but is restricted to the boundaries of the company's perspective and the existing resources that match this perspective. In this chapter the conceptual findings presented in the previous chapters will be translated into a quantitative framework which makes it possible to test the hypotheses defined in Chapter five.

6.2 A quantitative framework to measure exploitation

In Chapter two it was concluded that the process of production and the process of value creation can be measured by using financial analysis. In Chapter three generic strategies were introduced to determine whether the scope of the process of production and value creation is stable or if a change of focus or incremental innovation occurred. In this section financial value, the variables related to the defined generic strategies and the interrelation between the variables will be defined. This section will conclude with several limitations of the proposed quantitative model of exploitation.

6.2.1 Financial value as an instrument to measure exploitation

In order to develop a framework to measure exploitation, financial analysis and financial value needs to be operationalised. According to Copeland, Koller and Murrin (Copeland et al, 1990), earnings per share (EPS), which is frequently used as the measure for valuation, is not a proper indicator of the financial

value of a company. They argue that the stock markets are primarily interested in long-term cash flows (Rappaport, 1986). Luehrman (Luehrman, 1997) provides an overview of the different problems a manager faces and recommended a different valuation method for each of these problems (Figure 6.2).

Problem Type	Recommended valuation
Past Investment decisions	Adjusted present value
Operations (assets in place)	Based on cash flow
Future investment decisions opportunities (real options)	Simple option pricing
Equity Claims	Equity cash flow

Figure 6.2: Valuation problems and methods

Exploitation, related to the process of production and value creation, has distinct similarities with the type Luehrman defined as "*operations*", therefore, cash flow, defined as net profits plus depreciation, is the best measure of financial value (Copeland et al, 1990). In addition to cash flow operational cash flow can also be used. Operational cash flow (OCF) is defined as net profit plus depreciation, plus elements such as tax, other financial costs and extraordinary results. The advantage of operational cash flow over cash flow is that several aspects of financial engineering do not influence OCF as they do the ordinary cash flow. Since OCF is directly related to CF and the development of OCF is directly related to the development of CF (figure 6.3), OCF is chosen to measure the development of exploitation.

6.2.2 Quantification of generic strategies

Exploitation has to do with the relationship between the production process and the value creation process. In Chapter three the value chain and value

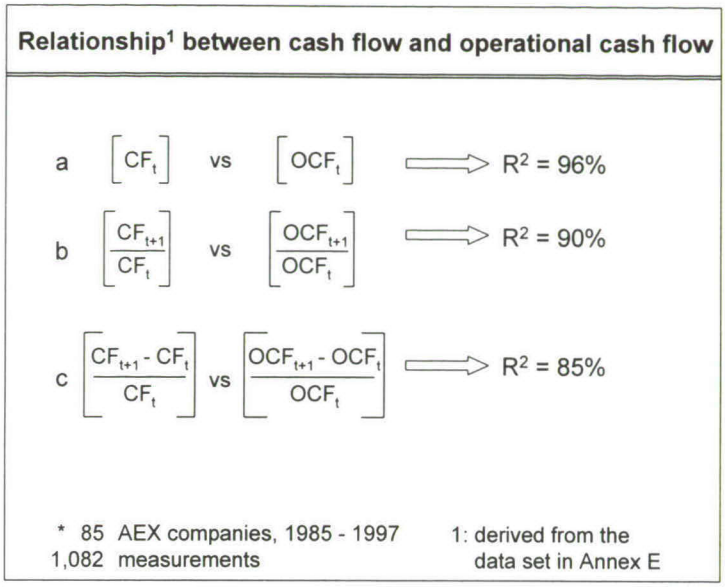


Figure 6.3: Relationship between cash flow and operational cash flow

chain analysis were used to analyse the existence or absence of an exploitation scope. The value chain, as a system of interdependent discrete activities, is defined as a system related to the process of production. Furthermore, the process of value creation is related to the position of the company in a large stream of activities, the value system.

In order to detect incremental innovation a change in the selection of one of the three generic strategies (volume, efficiency and added value) must be made quantifiable. OCF, as the indicator of financial value, needs to be disaggregated to classify companies based on the defined three generic strategies. The conceptual framework presented in Chapter three, based on the work of Porter (Porter, 1980, 1985) and Karnani (Karnani, 1984), is quantified. The suggested quantification has many similarities with the study by Karnani (Karnani, 1984) of the existence of generic strategies and the work of van Asseldonk (van Asseldonk, 1989; 1998) on the quantification of Porter. In Chapter three, three generic strategies were defined:

Volume

A volume strategy means that most of the created value can be related to a higher turnover without changing the added value per unit turnover or the company specific cost-ratio per unit turnover. As a result a volume strategy (V) can be identified when most of development of the operational cash flow can be related to the development of turnover (*equation 6.1*).

$$6.1 \qquad V = turnover$$

Efficiency

An efficiency strategy means that most of the created value can be related to a decrease in company specific costs per unit turnover. As a result an efficiency strategy implies that most of the developed operational cash flow can be related to a reduction of costs per unit turnover. Efficiency is related to the costs within the value chain of the company; purchasing elements are therefore left out and it is assumed that competitive pressure ensures that purchasing is not the basis of the value creation process. An analysis of the cost structure of the added value activities of 85 companies over a period of ten years (1,082 measurements) identified employment costs as the most important and significant type of costs (Figure 6.4). Therefore, efficiency-driven companies mostly focus on the level of employment costs related to the development of their turnover. Efficiency thus represents the company's value chain (employment costs as the most relevant factor of added value) in relation to the value system (turnover). As a result the level of efficiency (E) can be defined as:

$$6.2 \qquad E = turnover \,/\, employment\ costs$$

Added value

An added value strategy means that most of the created value can be related to an increase in added value per unit turnover. A successful added value strategy combines uniqueness and customer value with higher margins or added value if the price premium exceeds the extra costs incurred by being unique.

Costs as part of the added value of firms*		
Type of cost	Average	SD
Employment	71%	13
Depreciation	12%	7
Tax	8%	8
Interest and other financial costs	7%	7
Rest	2%	4
* 85 companies 1,082 measurements	100%	

Figure 6.4: Costs as part of the added value of companies

Added value-driven companies try to expand their position in the value system by developing additional services in order to earn additional cash on the basis that customers are willing to pay a premium price for these services. In financial terms:

$$6.3 \qquad A = \text{added value} / \text{turnover}$$

This ratio reflects the development of the ability of a company in terms of its value chain assumes that the value system remains unchanged.

Measurement of the activities of the value chain is based on the change of added value of the company in relation to the development of the value system. The broadest measure of the value system in relation to the company is the turnover of the company.

Added value is defined as employment costs, plus depreciation, plus tax, plus interest and other financial costs, and net profit (Figure 6.4).

6.2.3 A quantification of exploitation

Consistent with the findings of Karnani (Karnani, 1984) which are presented in Chapter three, the quantitative framework does imply the existence of a continuum per generic strategy. Through disaggregating the development of the OCF it is possible to identify which generic strategy generates most of the OCF per annum and which generic strategy dominates on a longitudinal basis.

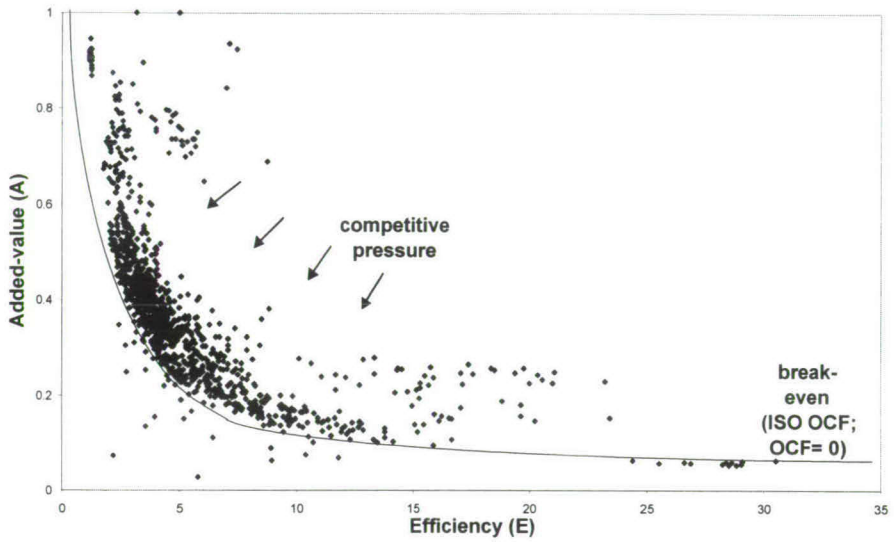


Figure 6.5: Efficiency versus Added value

As a result a three-dimensional (efficiency, added value, volume) graph can be drawn in which the development of OCF of every company can be shown. For the ease of interpretation two two-dimensional graphs are proposed. In the first graph (Figure 6.5) efficiency and added value are plotted. A line $A - 1 \div E = 0$ is also plotted. This break-even line is hyperbolic and represents a situation were no OCF per unit turnover is generated. $(A-1 \div E)$ is the performance of the company. Using the data set (Annex 1) which will be discussed in Chapter seven, it can be confirmed that companies are stuck near the theoretical break-even line (Figure 6.5).

$$6.4 \qquad Performance = A - (1 \div E)$$

While companies aim to increase the level of their operational cash flow, competitive pressure (Figure 6.5) pushes companies to the break-even curve and forces them to choose a specific strategy. The combination of performance and volume adds the third dimension. Given the restrictions of exploitation, i.e. a focus on the process of production and a short planning horizon, a company maximises the development of its operational cash flow.

6.5 *Operational cash flow = performance x turnover*

The exploitation model suggests that by differentiating the equations, it is possible to calculate the differentials of the three generic strategies and derive the maximum potential development of operational cash flow. This might be true theoretically. In practice, however, the effort to implement this theoretical optimum differs per company and per generic strategy. As a result comparing the percentage growth of each of the three generic strategies with a comparable level of growth in operational cash flow does not provide any insight into the real effort it takes to realise these ambitions. From equations *6.10* and *6.11* it may be concluded that the level of additional volume or turnover is always more than the additional level of added value (*equation 6.10*) or efficiency (*equation 6.11*) to provide the identical increase in operational cash flow. The increase in efficiency is always more than the additional level of added value to provide the identical increase in operational cash flow (*equation 6.12*, Figure 6.6).

6.2.4 Model boundaries

Based on the theoretical background and the conversion of the proposed conceptual framework into a quantitative framework, several boundaries or limitations are found related to the use of financial modelling, the use of operational developments and the existence of generic strategies.

Financial modelling has two major disadvantages. The first disadvantage is that financial data is always historical information. Conclusions can therefore only be drawn about the past strategic behaviour of companies. This disadvantage can also be seen as an advantage since implicit and emergent strategies can also be measured: in this model, behaviour and not intention is what counts.

V	Turnover	
AV	Added value	
EC	Employment costs	
OCF	Operational cash flow	
V = TO	Volume	*(6.1)*
A = AV÷TO	Added value	*(6.3)*
E = V÷EC	Efficiency	*(6.2)*
P = (A-EC)÷TO	Performance	*(6.6)*
P = A - (1÷E)		*(6.4)*
OCF = TO * P		*(6.5)*
OCF = TO * (A - (1÷E))		*(6.7)*
Full differential:	d(OCF)= (A - (1÷E)) * dV + V * dA + V * (1÷E^2) * dE	*(6.8)*
	d(OCF)= OCF÷V * dV + V * dA + EC^2÷V * dE	*(6.9)*
Equilibria:		
a	dV÷dA = V^2 ÷ OCF >> 1	*(6.10)*
b	dV÷dE = EC^2 ÷ OCF >>1	*(6.11)*
c	dE÷dA = V^2 ÷ EC^2 >> 1	*(6.12)*

Figure 6.6: The proposed model

The only relevant comparisons between companies, given the framework, are analyses of the development of these companies over the same period of time; the comparison is not based on the absolute position of the variables of these companies. As a result, a longitudinal analysis is required to detect developments. The proposed model provides an overview of the retrospective generic strategy of a company. However, it is assumed that these strategies are path-dependent, no conclusions about the future can be drawn from historical data.

Another limitation is related to the inconsistency of the data: companies may change their accounting models so frequently that any longitudinal analysis does not provide an accurate picture. Therefore it was decided to use only published financial data from companies listed on the Amsterdam Stock Exchange. This does not indicate that the data provided is 'correct' but it is at least verified by advisors, as well as by regulators. The model also assumes the existence of competitive pressure. Industries where competitive pressure is minimal due to the industry structure or for other reasons cannot be analysed properly.

The optimisation variable is defined as operational cash flow. Financial engineering has not been excluded from the framework. The implication of financial engineering is hard to detect, however choosing OCF over CF reduces of the impact of financial engineering. Outsourcing may have a major impact on the development of both efficiency and added value. If the initial aim of outsourcing is to produce more cheaply then outsourcing has an efficiency aim, which can be traced back in the model by lowering the employment costs but, as a result, the level of added value decreases also. If a company is able to increase the level of cash flow as result of this step then the outsourcing development can be defined as a successful efficiency change. If, however, a company aims to develop new products and additional services related to these products this should lead to an increase in the market price. Successful outsourcing also leads to an increase in cash flow. This development is defined as added value driven as the increase in market price keeps the initial position of the company in the value system intact.

The existence of generic strategies is frequently questioned (Corsten and Will, 1993) mainly given the fact that a company does not make a clear choice between efficiency and differentiation (Hall, 1980; White 1986). The proposed model does not question this critique but states that the result of explicit and implicit choices can be related to the level and development of value and from which perspective value is created. A study by Gertz and Baptista (Gertz and Baptista, 1995) found that choices contribute to the wealth of companies and therefore generic strategies are accepted as existent and relevant.

6.3 A quantitative framework to measure exploration

In Chapter four endogenous growth theory was chosen to analyse the stability of the development of resources. It was stated that within the company's perspective the development of resources is stable and that radical innovation implies a shift in the development of the company's resources. Apart from Solow many authors (see Chapter four) have studied economic growth theory and the development of residual value or productivity increases that cannot be related to a single core stakeholder. Griliches (1988, 1998) defined variables to measure the impact of R&D on the economic growth of a company and its productivity. Although Griliches used a modified version of the Solow-model,

the essential variables are identical. Therefore the variables defined by Solow are accepted as the variables to analyse stability on exploration or radical innovation.

6.3.1 Residual value to measure exploration

The accumulation of knowledge and the consequent build-up of residual value within a company requires a modification of Solow's original model of total factor productivity to create a company-specific model of total resource productivity. This means that the different variables (Figure 6.7) need to be adjusted and the interaction described.

Variable	Solow
Output	Private non-farm GNP
Capital	Employed capital
Unit	Man-hours
Correction	Inflation (1939 $ were used for all years)

Figure 6.7: The Solow variables for TFP

Output

The macro-economic definition of output, namely GNP, has to be converted into company-specific output. Given the definition of GNP, all outsourcing, intermediate services and goods should be deducted which results in the purest form of added value of a company. Following the definition of GNP, only company-specific resources are recognized as part of the added value (Griliches, 1998). As a result the output of a company is defined here as the employment costs, plus depreciation, plus net profit. This definition is different from the added value used in the previous Chapter since the economic perspective is different. The development of the output per company is probably more volatile than the development of the output of a country. This may cause sudden changes in the development of the residual.

However, the development of the residual is measured per employee and thus implies structural development of a company. Solow accepts that structural developments such as the Depression and the Second World War have an impact. As a result the development of the residual has an exogenous as well as an endogenous component.

Capital

On a national scale the preferred measurement of capital is the annual flow of capital, which is not available. As a result Solow accepted an estimate of the stock of capital goods in existence as the measurement of capital. However, this definition still raises many difficulties and "*would drive a purist mad*" (Solow, 1957), especially with regard to which capital goods are active or in function and which are idle. Solow was unable to solve this problem and defined the level of idle capital as proportional to the level of unemployment, stating that "*this is undoubtedly wrong, but probable gets closer to the truth than making no correction at all*".

On a company level the definition of functional capital is as hard as on a national level. Depreciation was chosen since depreciation follows Solow's intention of measuring the flow of active capital and follows Griliches (Griliches, 1998). The alternative would be the development of assets, however, there is some doubt about how to measure the idleness of assets. The proportional development of the annual flow of active capital, which was impossible on a national level, can be measured by the development of depreciation which is directly related to the development of capital services and fits into the example that Solow could not solve on a national level. Depreciation is accepted by stating that it has at least three limitations and consequences, because it is only related to active capital and it is expected that the level of accuracy of the proportions between depreciation and capital will be higher than measuring the alternative, namely measuring assets. Choosing depreciation will decrease the level of the annual development of TFP since the share of capital on a national level will be higher than the capital share at company level. This can be overcome since it is not intended to make a comparison of the actual build-up of the residual but to analyse the stability of the build-up of residual.

Man-hours

The initial analysis by Solow was calculated based on the hours worked. The basis for the calculation of the company's aggregate production function is the number of employees based on full-time equivalents.

Inflation

Solow calculated the development of TFP for the United States of America over the period 1909 to 1949. Every dollar calculation was done in the dollar value of 1939 as a means of correcting for inflation. At company level this correction is not carried out since it is unknown what level of inflation to take: different companies have different business activities and are active in different geographical markets. Since the calculation of company-specific TRP does not exceed thirteen years and overall European inflation during the 1985-1997 period was not extremely high, the calculation has been carried out in nominal guilders which have not been corrected for inflation.

6.3.2 A quantification of exploration

In economics, residual value can be increased by increasing the value of output per employee and by decreasing the level of capital per output. Due to the inherent relationship between GNP, capital and employment, there will be constant tension in the matter of how to develop residual value. The relationship between output, employment costs and depreciation as part of the model to calculate residual value has many similarities with the economic model. At the company level employment costs and depreciation also form the major part of the output as defined in this section. As a result there is a similar tension and hence from this perspective the economic model applies at company level. As a result of the altered variables the complete framework of the transformation from TFP into TRP emerges (Figure 6.8). The interpretation of Solow's equation (*Equation 4.10*, Chapter four) therefore changes into a new definition of company-specific residual change. Output per employee is defined as the sum of employment costs, depreciation and net profit per employee.

The change in residual value per time is defined as the change in the output per employee, minus the change in depreciation per employee, multiplied by the

proportion of depreciation per output unit. Following Solow it could be stated that the cumulative level of the productivity increase per employee is divided into a capital and a residual development, which cannot be attached to one of the core-stakeholders. The residual build-up is defined as technical change on a macro-economic level. It consists of successfully developed resources that cannot be attached to one of the core stakeholders. It is also defined as residual value or as an expression of intellectual capital (Stewart, 1997).

	Aggregate production function according to Solow DA/A = Dq/q - wk*Dk/k dR = DOe - C/O*DCe Residual change = = change of output per employee -/- capital per output * change of capital per employee	
	TFP (Total Factor Productivity)	TRP (Total Resource Productivity)
output	Private nonfarm GNP	Added value of companies defined as: Turnover minus all outsourcing intermediate goods and services. Output is defined as: Employment costs + Depreciation + Net profit.
capital	Employed capital	Depreciation
unity	Manhour	Employees (fte)
periodicity	Yearly	Yearly
correction	Inflation (1939 $ were used for all years)	None

Figure 6.8: Translating TFP into TRP

TRP measures the accumulation of knowledge and the build-up of the residual within a company. Based on the initial model developed by Solow, a sudden positive shift in the development of company-specific TRP implies radical innovation or a radical change in the perspective of the company. This change

of perspective is related to the development and successful initial deployment of residual value or intellectual capital related to this new perspective.

6.3.3 Model limitations

The restrictions of the model are related to inconsistencies in measurements and the difficulty of interpretation such as the use different accounting principles by different companies and the change of accounting principles over time, which implies that comparisons of the actual development of TRP between companies should be limited. Secondly the TRP analysis is not developed to analyse all the factors that influence the development of TRP. The findings of Abramowitz (Abramowitz, 1991) that the qualitative models available only partly support quantitative analysis on a national scale probably also applies to companies. Given the aim of calculating TRP, i.e. to detect radical innovation, it is not the interpretation of the residual build-up but the stability of the build-up and the interpretation of the irregularity of the TRP build-up per company which is the aim of this research. However, according to a well-known Dutch proverb "to measure is to know", and this may result in a deeper understanding of the development of residual value, knowledge, resources or intellectual capital.

6.4 Integrative approach and limitations

Using the variables defined in sections 6.2 and 6.3, the development of both exploitation and exploration can be measured. Figure 6.9 lists the relevant variables which can be derived from annual reports. The correspondence of the data is related to the fact that both exploitation and exploration are related to generic firm processes and to the core stakeholders of the company. The two models to detect stability on exploitation or incremental innovation and stability on exploration or radical innovation are shown in Figure 6.10.

Given the five generic processes and core stakeholders defined in Chapter two, the tension and interaction between these processes becomes evident. A focus on exploitation implies a maximisation of net profits and depreciation, and a maximisation of turnover. It is argued that a maximisation is possible through the use of a generic strategies.

Variables used / Standard P&L statement	Definitions					
	Exploitation		Exploration			
	Added Value (AV)	Operational Cash Flow (OCF)	Output (O)	Capital (C)	Output per employee (Oc)	Capital per employee (Ce)
Turnover						
Intermediate goods						
Employment costs	X		X		X	
Depreciation	X	X	X	X	X	X
Tax	X	X				
Interest	X	X				
Miscellaneous	X	X				
Net profit	X	X	X		X	
Number of employees (fte)					X	X

Figure 6.9: Data used for the proposal model

Aspects	Exploitation	Exploration
Background	Strategic management industry-based strategic management Porter (1980; 1985)	Economics Endogeneous growth theory Solow (1957)
Variables	V = Turnover D = Differentiation E = Efficiency V = TO D = AV / TO E = TO / EC	O = Output Oe = Output per employee C = Capital Ce = Capital per employee
Equation	OCF = V* (D - 1/E) (6.7)	dR = dOe - C/O*dCe (6.13)
Maximisation parameter	OCF	dR
Maximum when	max V: max Turnover max P: max OCF by Turnover max D: max added value by turnover max E: min employment costs by turnover	max: delta output per employee min: depreciation per output min: delta depreciation per employee
	Integrative approach: balancing between incremental and radical innovation	
Conceptual difference	Static	Dynamic
Operational difference	max: depreciation per turnover ⟷ min: depreciation per output min: employment costs per turnover ⟷ max: output per employee	

Figure 6.10: Integrated approach to innovation

A focus on exploration implies a maximisation of output per employee and a minimisation of both employee costs and depreciation per employee. It is clear that within this model a single focus on exploitation hinders the development of exploration and vice versa, due to the role of depreciation and the company versus employee specific orientation of optimisation.

A change of perspective or change of high order is a relatively short burst and has a major impact on the development of all generic firm processes and the core stakeholders. A change in the scope of the production process however may lead to a different generic strategy and hence a difference in the financial value creation process. Both changes have an impact on the production configuration process. As found in Chapter three, programmes such as lean production and business process re-engineering, not only change the production process itself but may also change the configuration of production in the sense that certain activities within the value chain are introduced, eliminated or replaced. As a result, incremental and radical innovations are also connected (Figure 6.11). The production configuration process is essential to bridge these two innovations to create different generic firm processes. The production configuration process converts resources into products that fit the formulated vision by fitting the organisation and includes procurement, technology development and human resource management.

In the previous two sections several limitations were discussed regarding the use and interpretation of the proposed models. Besides these limitations it should be noted that the equations provided were not developed to provide an algorithm to calculate a theoretical optimum. The proposed model has been developed to provide a framework to detect how specific developments affect the configuration, behaviour and success of a company and how they may be helpful in understanding the impact of these developments. The framework does not foresee or initiate these developments but is intended as an instrument to detect stability or change.

However, understanding the factors that induce these changes might change an emergent strategy into a deliberate one.

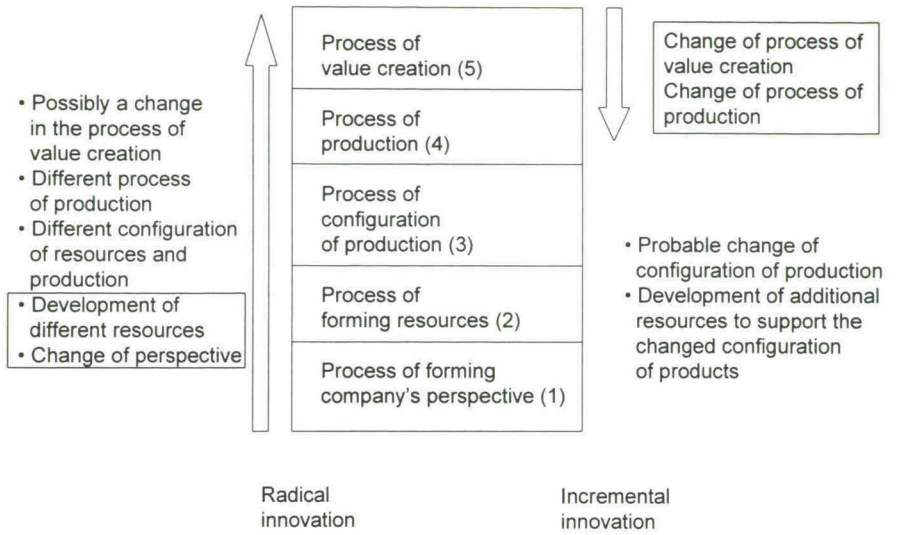


Figure 6.11: Relationship between incremental and radical innovation

Based on the framework defined in Chapter two, the process of seeking this balance, defined as the strategy process, is related to the core stakeholders, generic firm processes and planning horizon (Figure 6.12).

- Core stakeholders:

  Choices have to be made about which core stakeholders to focus on, how to attract new core stakeholders and how to retain current core stakeholders. From this perspective both competition as well as the companies for core stakeholders but also the ambition or perspective of the core stakeholders and their scarcity will play a major role in the strategy process.

- Generic firm processes:

  The content of the five generic firm processes and their interrelationships are also very important in the strategy process of a company. Choices related to the company's perspective, its resources, the production configuration, the actual production and value creation not only influence the direction of development of the company but also its competitive position in relation to obtaining specific core stakeholders.

- Planning horizon:

  Besides core stakeholders and generic firm processes the planning horizon is also relevant since the planning horizon foresees the time frame for optimisation.

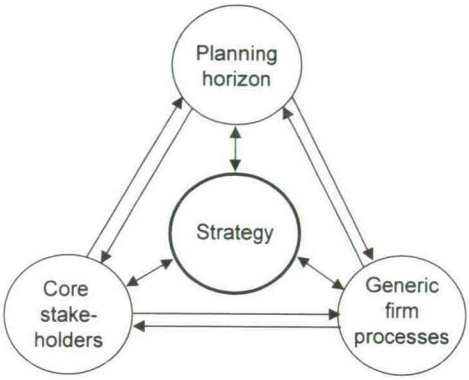


Figure 6.12: Three groups of choice related to strategy

The market or the interaction between the company and its environment is broader than the traditional markets where companies compete for the buying power and loyalty of customers and where companies compete for the buying power and loyalty of investors or shareholders. The market for employees and partners is also increasingly competitive, at least in the Western Hemisphere. Choices have to be made by defining a strategy related to the processes and the content of the interactions of a company and its environment. Based on the exploitation-exploration dilemma a balance has to be found between short-term versus long-term and between operational value creation versus long-term dominance (see Figure 6.13).

Choices related to strategy imply a difference in the approach towards core stakeholders, generic firm processes and the planning horizon. Finding a balance also implies that the above choices can be differentiated over time, per core stakeholder and per generic process. Based on the company's objective and the level of scarcity per core stakeholder, different choices can be made.

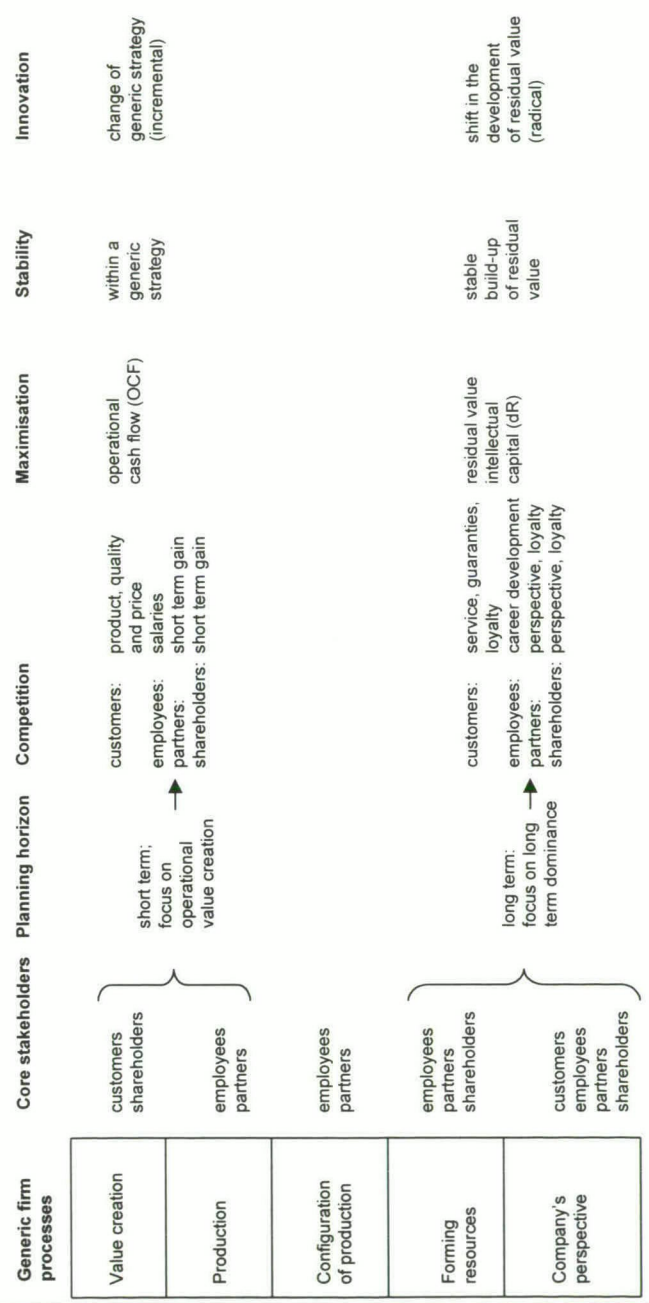
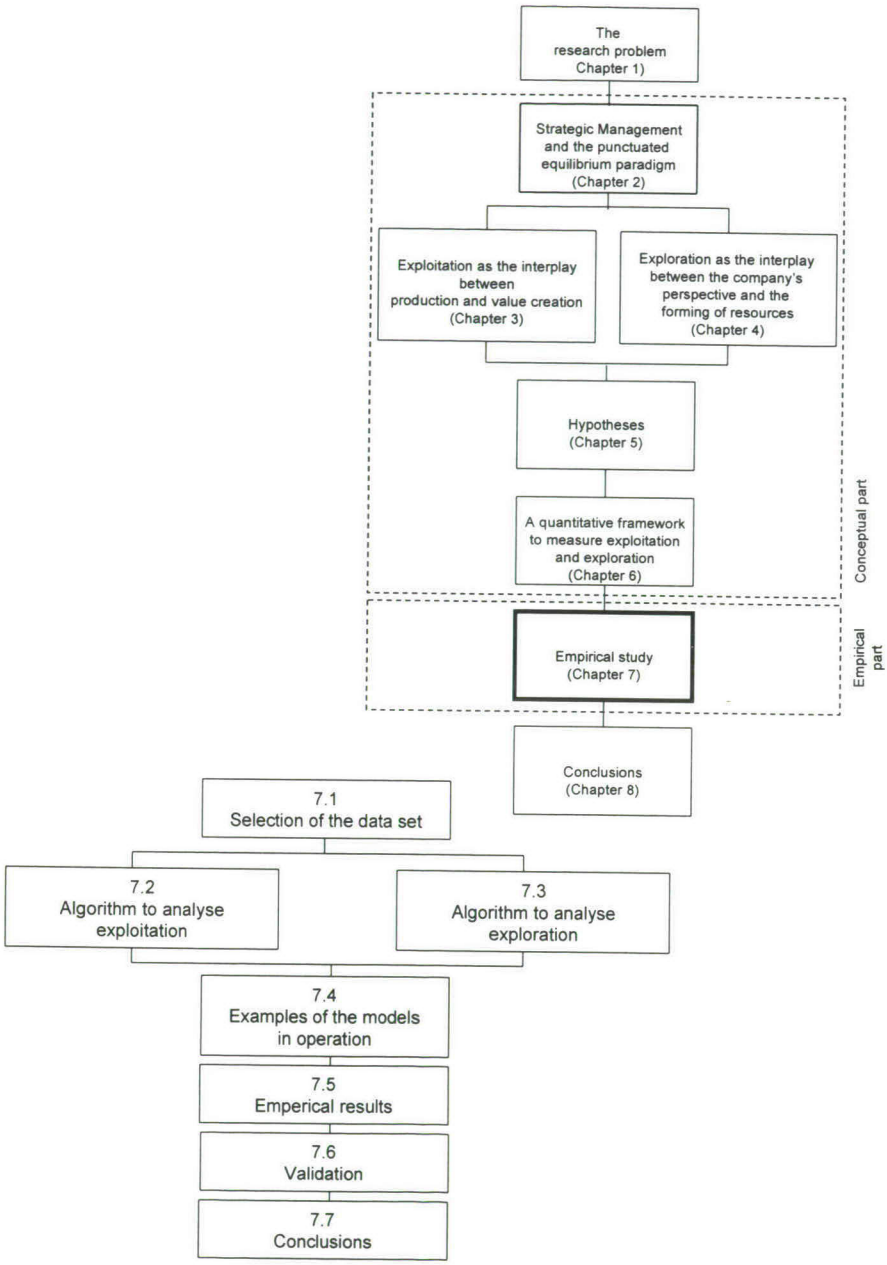


Figure 6.13: Integrated approach to strategy to detect the exploitation – exploration dilemma


The research problem Chapter 1)
Strategic Management and the punctuated equilibrium paradigm (Chapter 2)
Exploitation as the interplay between production and value creation (Chapter 3)
Exploration as the interplay between the company's perspective and the forming of resources (Chapter 4)
Hypotheses (Chapter 5)
A quantitative framework to measure exploitation and exploration (Chapter 6)
Conceptual part
Empirical study (Chapter 7)
Empirical part
Conclusions (Chapter 8)
7.1 Selection of the data set
7.2 Algorithm to analyse exploitation
7.3 Algorithm to analyse exploration
7.4 Examples of the models in operation
7.5 Emperical results
7.6 Validation
7.7 Conclusions

7. Empirical study

To test the hypotheses presented in Chapter five the proposed quantitative frameworks on exploitation and exploration will be transformed into specific frameworks. This Chapter presents the empirical part of the study and includes these algorithms, several case studies based on the proposed algorithms, results using the selected data set, a validation of these findings, and initial conclusions based on the empirical quantitative analysis. Before presenting the algorithms in sections 7.2 and 7.3, the next section will consider the data set.

7.1 Selection of the data set

A data set has to be selected to detect stability in exploitation or incremental innovation and stability on exploration or radical innovation and to validate the proposed framework. Given on the proposed framework the data needed for validation can be derived from annual reports. Because of the nature of this study, a longitudinal analysis is essential. To compensate for an atypical year, which might distort the analysis, a minimum of ten years of data is required. Ten years is expected to be sufficient to detect incremental and radical innovations. Although, it is not expected that all companies will change their high order within every ten years, it is still expected that enough incremental and radical innovations will be detected to be able to draw conclusions from this analysis. Furthermore, in order to provide an integrated picture of incremental and radical innovation, the companies and years selected should be the same in both models.

To ensure the consistency of the data, the data should have undergone rigorous screening, at least by an independent auditor. Using data from publicly traded companies ensures that the data will have been subject to such screening and that all the relevant companies are required to present their data in accordance with the regulations of the relevant stock exchange. Amsterdam was chosen since the companies listed show a wide diversity on size, activity and geographical operational presence. The size of the companies, as well as their industry typology and their geographical location is diverse, which minimises the possibility of a bias based on size, industry code or geographical presence.

Apart from the balance sheet and profit and loss account other elements such as the number of employees are recorded. Annex 1 provides a list of companies and years covered. Including only companies that have been listed for longer than 10 years reduced the list of companies. To increase the number of data points per company, it was decided to use data from 1985 onwards if available, but no later than 1988, 1997 being the latest year. Of the 207 companies listed on the Amsterdam Stock Exchange in 1988, 142 were still listed in 1997. Since this meets the above criteria, this group of 142 companies was defined as the total population (100%). Sufficient data from 85 companies was found. This means that 60% of the population is analysed. The sample of 85 companies represents 93% of the market value of the 142 companies previously defined as the whole population in 1997. Figure 7.1 provides a summary and analysis of the data on incremental and radical innovation.

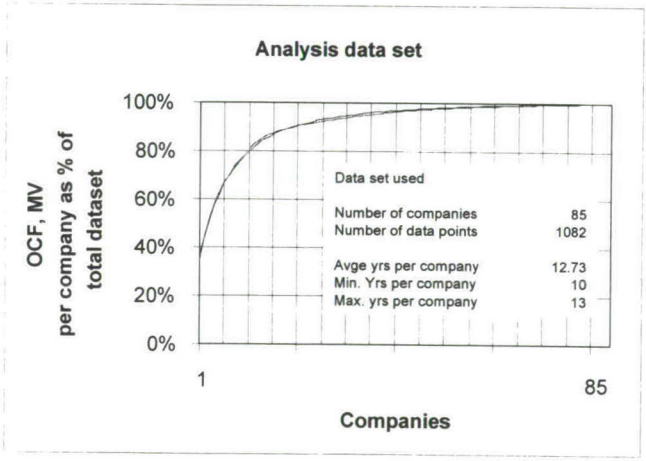


Figure 7.1: Summary and analysis of the data used

7.2 Algorithm to analyse exploitation

The exploitation model was presented in Chapter six. In this section an algorithm is developed to categorise companies as stable, and thus related to a single generic strategy, or as incremental innovation companies. In the description of the algorithm data from Aalberts Industries N.V. (Aalberts) will be used to illustrate the various steps. The data derived from the annual reports

of Aalberts and the calculated variables based on the model are shown in Figure 7.2.

Aalberts Industries N.V.					
Year	Turnover (V) (NLG millions)	Efficiency (E)	Added value (A)	Performance (P)	Oper CF (OCF) (NLG millions)
1985	36.722	4.238	0.399	0.164	6.006
1986	47.240	3.762	0.443	0.177	8.365
1987	47.834	3.670	0.462	0.190	9.078
1988	70.918	3.790	0.439	0.175	12.406
1989	100.251	3.815	0.445	0.182	18.369
1990	100.394	3.554	0.475	0.194	19.447
1991	195.597	3.751	0.422	0.155	30.317
1992	210.772	3.487	0.443	0.156	32.971
1993	224.233	3.273	0.463	0.157	35.267
1994	285.356	3.225	0.471	0.161	45.869
1995	365.626	3.240	0.472	0.163	59.629
1996	470.940	3.065	0.494	0.168	78.898
1997	611.451	3.099	0.485	0.162	99.176

Figure 7.2: Data used as basis for analysis of incremental innovation

A company can be categorised as stable when the change in one of the variables is consistent over the period of the analysis and when a major part of the total development of the operational cash flow of the company can be related to the development of that variable. As a result a company can only be categorised as stable in terms of a single generic strategy or incremental innovation. To make sure that every categorisation is objective and not based on the behaviour of atypical years, the analysis is split in two parts; an analysis of the consistency (c) of the development of the variables related to the three generic strategies, and an analysis on the cash impact (i) as a result of the development per variable. A combination of these two analyses (c*i) leads to a categorisation (Figure 7.3). In order to analyse year-to-year developments on consistency, Boole's analysis is chosen to gain from its objectivity and computational ease.

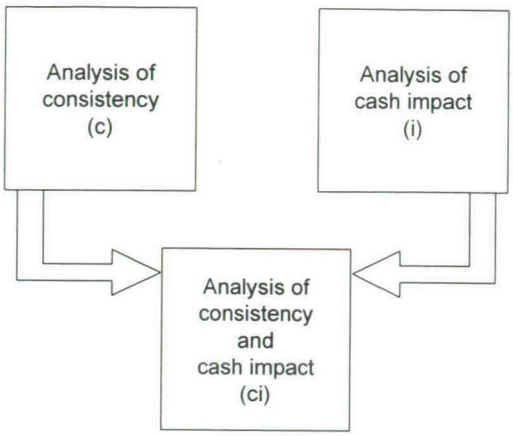


Figure 7.3: Structure of the analysis of incremental innovation

7.2.1 Analysis of consistency

In order to see whether the development of the three variables (volume, efficiency and added value) and performance showed year on year growth, year-on-year consistency was calculated (Figure 7.4) and transformed into a Boole's statement (Figure 7.5). An extra hurdle, α_c, was added related to the level of growth (Figure 7.6). This hurdle may be related to all the defined variables. By default α_c is zero, which implies that any positive development will lead to a Boole statement of '1'. By altering α_c a threshold is developed that influences the categorisation on consistency of a company. A development in efficiency, added value or performance represents a change in the nature of the underlying relationships between added value and turnover, employment costs and turnover and operational cash flow and turnover.

These developments are more difficult to achieve than a single change in turnover. Therefore, the volume hurdle should be higher than zero. For the purpose of this study the consistency volume hurdle is set at twice the growth of GDP in the Netherlands. Although several arguments can be found in defining a different hurdle, the growth of GDP is accepted since it provides the best indicator of growth in general. Also the choice of twice the GDP growth is arbitrary, however no arguments that provide an alternative were found. The growth of GDP in the Netherlands between 1988-1997 was 4.5% per annum (CPB, 1999).

As a result a Boole's statement will result in '1' if a company grew faster than 9% per annum.

Aalberts Industries NV				
Year to year	V	E	A	P
1985-1986	0.286	-0.112	0.109	0.083
1986-1987	0.013	-0.024	0.044	0.072
1987-1988	0.483	0.033	-0.051	-0.078
1988-1989	0.414	0.007	0.015	0.047
1989-1990	0.001	-0.068	0.067	0.057
1990-1991	0.948	0.055	-0.112	-0.200
1991-1992	0.078	-0.070	0.051	0.009
1992-1993	0.064	-0.061	0.044	0.005
1993-1994	0.273	-0.015	0.017	0.022
1994-1995	0.281	0.005	0.002	0.015
1995-1996	0.288	-0.054	0.047	0.027
1996-1997	0.298	0.011	-0.018	-0.032

Figure 7.4: Development per variable

Analysis of consistency (c)

Per:
- company (x) (85 companies)
- year to year development (t) (1985-1997)
- variable (c) (V; P; E; A)

Hurdle:
- α_c
- default $\alpha = 0$
- α_c volume = 0.09

Algorithm:

FOR x = 1 to max
t = 1 to max
c = V; P; E; A

DO IF $\dfrac{cxt_1 - cxt_0}{|\ cxt_0\ |} > \alpha_c$

then value = 1
otherwise value = 0

Figure 7.5: Structure of analysis of consistency

Based on the previous figure a Boole's statement can be derived:

Aalberts Industries N.V.				
	c(V)	c(E)	c(A)	c(P)
1985-1986	1	0	1	1
1986-1987	0	0	1	1
1987-1988	1	1	0	0
1988-1989	1	1	1	1
1989-1990	0	0	1	1
1990-1991	1	1	0	0
1991-1992	0	0	1	1
1992-1993	0	0	1	1
1993-1994	1	0	1	1
1994-1995	1	1	1	1
1995-1996	1	0	1	1
1996-1997	1	1	0	0

Figure 7.6: Development in consistency per variable transformed to a Boole's statement

7.2.2 Analysis of cash impact

By relating the year-on-year development in the different variables to their impact on the development of the operational cash flow, the cash impact can be categorised. A cash impact analysis consists of two parts. Based on the model and the full differential (*equation 6.8,* Figure 6.9) the cash impact per initial change per variable can be calculated. However, the differential is only useful when the developments per variable are minor. This is not always the case and, combined with the simultaneous developments of the different variables, decreases the accuracy of the findings based on the full differential. As a result the cash impact analysis is split into a first order and second order analysis.

The first order analysis is based on the full differential and the second order analysis is to allocate the remaining operational cash flow based on the proportion of the first order allocation.

This method is arbitrary but accepted as a sufficiently accurate algorithm to relate the development of operational cash flow to the development of the different variables, since most of operational cash flow is allocated as a result of the first order analysis and all operational cash flow is allocated as a result of both the first and second order analyses. Given the hierarchy of the variables (*equations 6.4* and *6.5*) the developments of efficiency and added value are not linearly related to the development of the operational cash flow. The hierarchy also implies that the development of the cash impact due to a change in efficiency and added value will be related to the cash impact of the performance variable (Figure 7.7).

If the cash impact of the performance exceeds the cash impact of the volume a company can be defined as Boole's '1' in terms of efficiency or added value. Efficiency and added value strategies are distinguished based on whether the cash impact of efficiency exceeds the cash impact of added value or vice versa. As was the case in the analysis of consistency a hurdle is defined (α_i) which states what level the cash impact should exceed to become Boole's '1' annually. The default setting of this hurdle is 0.5 indicating that at least 50% of the overall cash impact must be related to volume for a company to be defined as Boole '1' for volume. A Boole '1' for efficiency or added value will apply when the respective cash impact is more than 50% of the cash impact of performance. This hurdle can be altered which may mean that companies shift between categories. To allocate the entire change in the operational cash flow per company, per variable, the differential from Figure 6.9 is calculated for each of the variables for each company and each year (Figure 7.8).

The first order effects only reflect the change when one of the variables is changed and the rest remain static. In order to provide the right allocation of cash, the simultaneous effect must be taken into account. The simultaneous effect is presented in Figure 7.9 for turnover and performance and in Figure 7.11 for efficiency and added value.

Analysis of cash impact (i)

Per:
- company (x) (85 companies)
- year to year development (t) (1985-1997)
- variable (i) (V; P; E; A)

Hurdle:
- α_i
- default $\alpha_i = 0,5$

Algorithm:

FOR
x = 1 to max
t = 1 to max
i = V; P; E; A

DO IF $\dfrac{i_v xt_1 - i_v xt_0}{| i_{v+p} xt_1 - i_{v+p} xt_0 |} > \alpha_i$
then value = 1
else value = 0

IF $\dfrac{i_p xt_1 - i_p xt_0}{| i_{p+v} xt_1 - i_{p+v} xt_0 |} > \alpha_i$
then value = 1
else value = 0

IF $\dfrac{i_A xt_1 - i_A xt_0}{| i_p xt_1 - i_p xt_0 |} > \alpha_i$
then value = 1
else value = 0

IF $\dfrac{i_E xt_1 - i_E xt_0}{| i_p xt_1 - i_p xt_0 |} > \alpha_i$
then value = 1
else value = 0

Figure 7.7: Structure of the cash impact analysis

V^1: $P(t_0)dV$
P^1: $V(t_0)dP$

E^1: $\dfrac{V(t_0)}{E^2(t_0)}dE$

A^1: $V(t_0)dA$

Figure 7.8: Algorithm for first order analysis

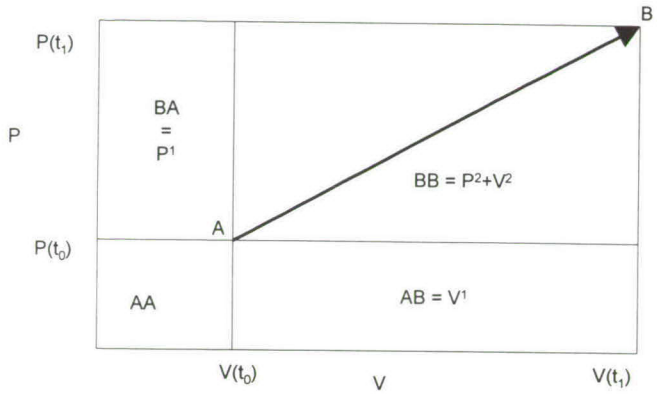


Figure 7.9: First and second order cash division between V and P

In this figure, the company moves from point A at t=0 towards point B at t=1. This change resulted in a change in operational cash flow of $PV(t_1)$-$PV(t_0)$. This compares with the areas AB, BA and BB. BA represents the change in cash flow as a result of changing the P from t=0 to t=1 and letting V remain t=0. BA thus represents the first order effect of P; P^1. Similarly, AB represents the first order effect of V; V^1. Area BB is the cash effect of a simultaneous change in P and V. This cash effect should be allocated according to the ratio between the cash effects of P and V, i.e. the ratio of areas AB and BA. The simultaneous cash effect can also be expressed as the total change in operational cash flow minus the two direct effects of performance and turnover. The equations for the second order effect are given in Figure 7.10:

$$V^2 = (\Delta \text{ cashflow} - (V^1 + P^1)) \times \frac{V^1}{V^1 + P^1}$$

$$P^2 = (\Delta \text{ cashflow} - (V^1 + P^1)) \times \frac{P^1}{V^1 + P^1}$$

$$\Delta \text{ cashflow} = OCF(t_1) - OCF(t_0)$$

$$V^{tot} = V^1 + V^2$$
$$P^{tot} = P^1 + P^2$$
$$\Delta \text{ cashflow} = V^{tot} + P^{tot}$$

Figure 7.10: Algorithm for the second order analysis of V and P

The second order allocation for efficiency and added value follows along similar lines. There is only one major distinction between Figure 7.9 and Figure 7.11. In Figure 7.9, the area ratios represent the cash impact ratios, while in Figure 7.11, the areas only represent the value of the cash impact of the variables (Figure 7.8).

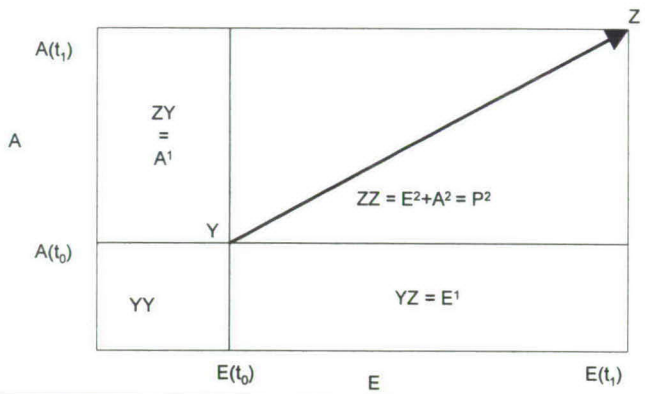


Figure 7.11: First and second order cash allocation between E and A

ZY is the change in total cash impact of performance due to a change in A. ZY is not calculated by multiplying $A(t_0)Y$ and $A(t_0)A(t_1)$, but by using the differential from Figure 7.8, $V(t_0)dA$. A change in E results in a change in the cash impact of performance represented by YZ. Again the simultaneous effect, ZZ, is allocated according to the ratios between the first order effects of A and E (Figure 7.12).

$$E^2 = (P^2 - (E^1 + A^1)) \times \frac{E^1}{E^1 + A^1}$$

$$A^2 = (P^2 - (E^1 + A^1)) \times \frac{A^1}{E^1 + A^1}$$

$$E^{tot} = E^1 + E^2$$

$$A^{tot} = A^1 + A^2$$

$$\Delta_{cashflow} = V^{tot} + E^{tot} + A^{tot}$$

Figure 7.12: Algorithm for the second order analysis on E and A

Aalberts Industries N.V.					
Year to year	V^{tot}	E^{tot}	A^{tot}	P^{tot}	Δcashflow
	(millions)				
1985-1986	1.831	-0.830	1.359	0.528	2.360
1986-1987	0.106	-0.306	0.913	0.607	0.713
1987-1988	3.972	0.395	-1.039	-0.644	3.328
1988-1989	5.350	0.129	0.484	0.613	5.963
1989-1990	0.026	-1.600	2.652	1.052	1.078
1990-1991	13.772	1.191	-4.093	-2.902	10.870
1991-1992	2.372	-1.858	2.140	0.282	2.654
1992-1993	2.116	-1.583	1.763	0.180	2.296
1993-1994	9.809	-1.014	1.807	0.793	10.602
1994-1995	13.082	0.439	0.239	0.678	13.760
1995-1996	17.603	-5.146	6.812	1.666	19.269
1996-1997	22.701	1.627	-4.050	-2.423	20.278

Figure 7.13: Total cash impact per variable

The mathematics of the second order effect will be illustrated using data from Aalberts Industries N.V. for the years 1985 and 1986. The total cash flow is 2,359,000. The first order effects of V and P are 1,720,252 and 496,530 respectively. V^1+P^1 explain an amount of (1,720,252+496,530 =) 2,216,782 in the change in operational cash flow. The difference 142,218 (2,359,000-2,216,782) is allocated according to the ratios of V to P. For V this ratio is: 1,720,252:(2,216,782) ≈ 0.78. The second order effect of V is now calculated as: 0.78 * 142,218 ≈ 110,363. The total cash impact of V is now the sum of V^1 and V^2 (1,720,252+110,363 ≈ 1,830,615). The first and second order impact obtained for Aalberts is given in Figure 7.13. Applying Boole's analysis with the hurdle α_i set at 0.5 results in the above figure for Aalberts (Figure 7.14).

7.2.3 Combining the consistency and cash impact analysis

The final part of the quantitative analysis is the classification of companies. Initially, the Boole's statements per company per variable and per period are multiplied which provides a new Boole's statement (Figure 7.16).

Aalberts Industries N.V.				
Year to year	i(V)	i(E)	i(A)	i(P)
1985-1986	1	1	1	0
1986-1987	0	1	1	1
1987-1988	1	1	1	0
1988-1989	1	0	1	0
1989-1990	0	1	1	1
1990-1991	1	0	1	0
1991-1992	1	1	1	0
1992-1993	1	1	1	0
1993-1994	1	1	1	0
1994-1995	1	1	0	0
1995-1996	1	1	1	0
1996-1997	1	1	1	0

Figure 7.14: Boole's statement derived from total cash impact

When the number of positive Boole's values for a variable is at least 50 % (α_{ci}) over the number of years (Figure 7.15), then that company may be classified as variable 'i' driven.

Thirteen years of data, i.e. 12 developments are available for Aalberts. For a variable to qualify as a stable generic strategy it needs at least $12*\alpha_{ci} = 6$ years with a Boole's '1' for consistency * impact and a maximum of Boole's '1' statements. In this case both variables V and A are qualified, because both have 8 Boole's '1' statements (Figure 7.17) which means that no direct choice can be made.

Therefore, a selection is made based on the sum of Boole's '1' statements for consistency (Figure 7.6) and Boole's '1' statements for impact (Figure 7.14). Based on this additional rule, Aalberts is categorised as an added value-driven company.

Analysis of cash impact and consistency (c * i)

Per:
- company (x) (85 companies)
- year to year development (t) (1985-1997)
- cash impact per parameter (ci) (b(V); b(P); b(E); b(A)) (Boolean values)

Hurdle:
- α_{ci}
- default $\alpha_{ci} = 0,5$

Algorithm:

FOR x = 1 to max
t = 1 to max
ci = b(V); b(P); b(E); b(A)

DO

$(cxt)_{consistency} * (ixt)_{cash\ impact}$

$\sum_{t_{min}}^{t_{max}} ci\ x = sum_{ci}\ x$

categorise f: IF $Sum_{ci}\ x > \alpha_{ci} * years$

THEN CHOOSE $Sum_{ci}\ x = max$

Figure 7.15: Structure of the analysis of consistency and cash impact

Aalberts Industries N.V.				
Year to year	ci(V)	ci(E)	ci(A)	ci(P)
1985-1986	1	0	1	0
1986-1987	0	0	1	1
1987-1988	1	1	0	0
1988-1989	1	0	1	0
1989-1990	0	0	1	1
1990-1991	1	0	0	0
1991-1992	0	0	1	0
1992-1993	0	0	1	0
1993-1994	1	0	1	0
1994-1995	1	1	0	0
1995-1996	1	0	1	0
1996-1997	1	1	0	0

Figure 7.16: Boole's statement derived from consistency and cash impact

Aalberts Industries N.V.				
Period	ci(V)	ci(E)	ci(A)	ci(P)
1985-1997	8	3	8	2

Figure 7.17: Sum of Boole's statements

7.2.4 Data normalisation

In section 7.2.2 the operational cash flow per variable and the total operational cash flow per company and per year were calculated. By adding these operational cash flows, the total operational cash flow per company, per variable is obtained. When the developments per variable for each company are aggregated and compared a distorted picture will emerge. The absolute differences between companies will make it impossible to compose the developments per company and per variable. Although it is not the aim of this thesis to compare companies but to detect a trend within a company over time, it is necessary to provide aggregated results in order to test the hypotheses. Therefore, normalisation of the data is essential.

Normalisation is implemented by defining twice the standard deviation of the cash flow per variable per company for the variables efficiency, volume and added value as '1'. This normalisation protocol is chosen since it generates normalised data without defining explicitly a single variable as dominant or with the value of '1'. The normalisation for Aalberts is presented in Figure 7.18.

Aalberts Industries N.V.				
	V^{tot}	E^{tot}	A^{tot}	Δcash-flow
OCF (x1.000.000)	92.740	-8.557	8.987	93.170
Normalised OCF	1,049	-0.097	0,102	1,054

Figure 7.18: Normalised total cash impact per variable

By normalising the development of operational cash flow per company, companies can be aggregated in such a way that every company has an identical weight.

7.3 Algorithm to analyse exploration

Using the model described in Chapter six, the year on year development of the residual value was calculated per company. As a default setting the residual value of the initial year of the analysis per company was defined as '1'. In the longitudinal analysis the cumulative build-up of the residual value, defined as variable R, was calculated. The results for Aalberts Industries N.V. (Aalberts) are presented in Figure 7.19.

Aalberts Industries N.V.					
Year	Output (per empl) (thousands)	Cap/Output	Capital (per empl) (thousands)	dR	R
1985	76.923	19.694%	15.149	0.018	1.000
1986	75.274	19.777%	14.887	0.045	0.982
1987	79.204	19.479%	15.428	0.076	1.027
1988	83.851	16.764%	14.057	0.038	1.103
1989	84.107	13.278%	11.167	-0.010	1.140
1990	83.071	13.185%	10.953	-0.047	1.131
1991	78.756	13.400%	10.553	0.040	1.084
1992	81.930	12.888%	10.559	-0.005	1.124
1993	83.141	14.635%	12.168	0.044	1.119
1994	86.561	13.762%	11.913	0.072	1.163
1995	93.471	13.489%	12.609	-0.099	1.235
1996	82.690	13.438%	11.112	0.153	1.136
1997	97.151	13.325%	12.945		1.288

Figure 7.19: Aalberts Industries N.V.: residual build-up

To minimise the effect of atypical years, the average development was calculated. Atypical years may be due to additional costs or income from non-operational activities. The result of calculating an average is that atypical years can be 'spread out' and no company-specific interpretation is possible. Given the aim of detecting shifts in the build-up of residual value, working with an average development makes it more difficult to detect these shifts. It also means that a shift is detected, it is not a one-year shift but represents a major shift in the residual build-up of the company.

7.3.1 Generic trend analysis

The analysis to detect trends in the build-up of residual value consisted of two steps. First, the cumulative build-up of residual value over the minimum period of ten years was analysed per company. Based on this data a linear regression line was calculated. The correlation (R^2) between the linear regression line and the calculated average residual build-up was generated. A high correlation (R^2) is interpreted as a stable development in residual build-up. A low correlation is interpreted as a chaotic or multi-linear development of residual build-up.

Besides the correlation between the linear regression line and the calculated average residual build-up, the direction or angle beta (β) of the linear regression line is also important. The value of beta provides information about the level of progress in the build-up of residual value.

In the proposed model a negative beta is interpreted as a negative build-up or a reduction in residual value. A positive beta is interpreted as a positive build-up of residual value (Figure 7.20).

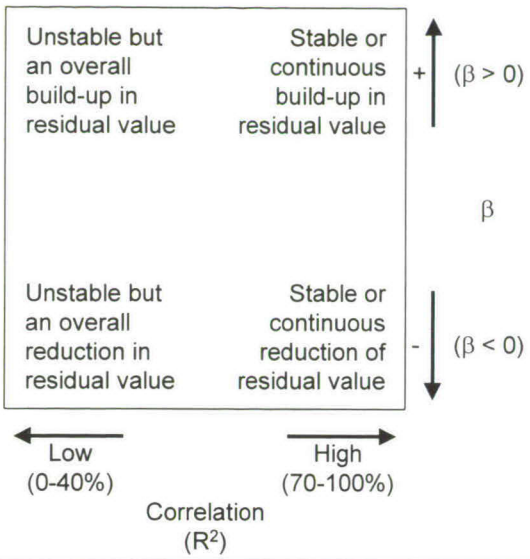


Figure 7.20: Initial categorisation of radical innovation

7.3.2 Detecting atypical developments in the residual build-up

The second step consists of the breakdown of the linear regression line into smaller periods. These smaller periods consist of groups of three-year floating averages with a similar direction. This direction can be related to the direction of the linear regression line. The angle of a period of floating averages (γ) can have a larger, similar or smaller angle than the linear regression line (β). Only when a linear regression line crosses a period this represents a significant change in the build-up. As a result, three categories of periods emerge. Firstly, there is the period whose line crosses the linear regression and the period angle gamma exceeds the linear regression's angle beta. This period is called a 'positive period'. Secondly, a period is defined as a 'negative period' when it crosses the linear regression and has a lower angle gamma than the beta of the linear regression line. Thirdly, the movement of a period along the linear regression line (gamma and beta are similar) is called a 'neutral period'.

When a positive period is followed by a negative period this development is defined as a negative break in the build-up of residual value. A positive break in the build-up is defined as the succession of a negative period by a positive period.

7.3.3 Combining generic trend analysis and detecting atypical developments of residual build-up

In order to detect trends in the build-up of residual value the two steps presented in sections 7.3.1 and 7.3.2 are combined. Based on the value of beta in the lineair regression line an initial distinction is made between companies with a positive beta and companies with a negative beta. This first division is essential since it provides information on the progress in residual build-up for the whole period analysed. Companies with a negative beta based on the correlation between the linear regression line and the calculated average build-up, are divided in three groups of companies with a low ($R^2 < 0.4$). middle ($0.4 < R^2 < 0.7$) and high ($R^2 > 0.7$) correlation. This division into three groups is arbitrary and is examined in section 7.6.3 where the impact of these boundaries is validated. Similarly, the division based on correlation is also applied to companies with a positive beta. Based on the findings of section 7.3.2 the three groups with negative, neutral and positive breaks can be identified. By combining these three methods of division a classification system (Figure 7.21) is established and a spectrum (Figure 7.22) is obtained.

	Negative Beta ($\beta < 0$)			Positive Beta ($\beta > 0$)		
	Low ($R^2<0.4$)	Medium ($0.4<R^2<0.7$)	High ($R^2>0.7$)	High ($R^2>0.7$)	Medium ($0.4<R^2<0.7$)	Low ($R^2<0.4$)
Positive break	Unstable damped tear down	Damped tear down	Stable damped tear down	Marginal build-up	Moderate build-up	Radical build-up
Neutral	Unstable continuous tear down	Moderate continuous tear down	Stable continuous tear down	Stable continuous build-up	Moderate continuous build-up	Unstable continuous build-up
Negative break	Radical tear down	Moderate tear down	Marginal tear down	Stable damped build-up	Damped build-up	Unstable damped build-up

Figure 7.21: Full categorisation based on radical innovation

	Negative Beta ($\beta < 0$)			Positive Beta ($\beta > 0$)		
	Low ($R^2<0.4$)	Medium ($0.4<R^2<0.7$)	High ($R^2>0.7$)	High ($R^2>0.7$)	Medium ($0.4<R^2<0.7$)	Low ($R^2<0.4$)
Positive break						Radical build-up
Neutral						
Negative break	Radical tear down					

Figure 7.22: Spectrum based radical innovation

The classification system consists of 18 cells. Based on this spectrum, four categories that form both ends and the centre of the spectrum will be described:

- Radical tear down

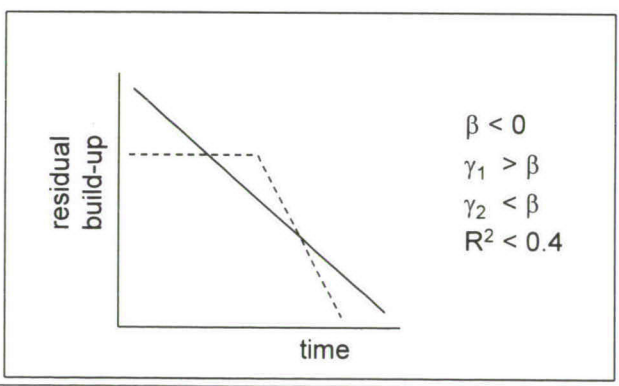


Figure 7.23: Radical tear down

A radical tear down occurs when the development of the residual value decreases much more than the overall negative development of residual value. Hence, the overall tear down is accelerated.

The low correlation (R^2) implies that the radical tear down should be interpreted as a major shift away from the linear regression line.

- Stable continuous tear down

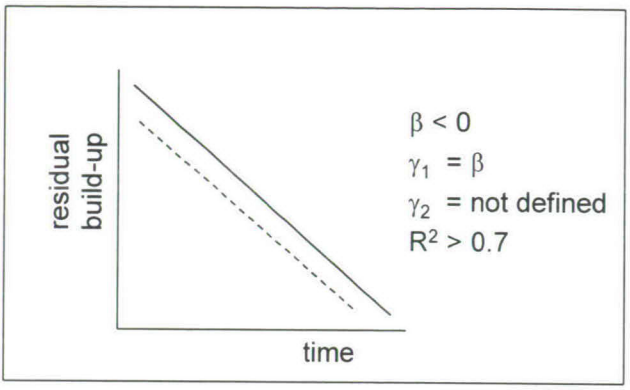


Figure 7.24: Stable continuous tear down

A stable continuous tear down implies an overall decrease in residual value. Due to the high correlation and the fact there are no breaks, the detected tear down is stable and continuous.

- Stable continuous build-up

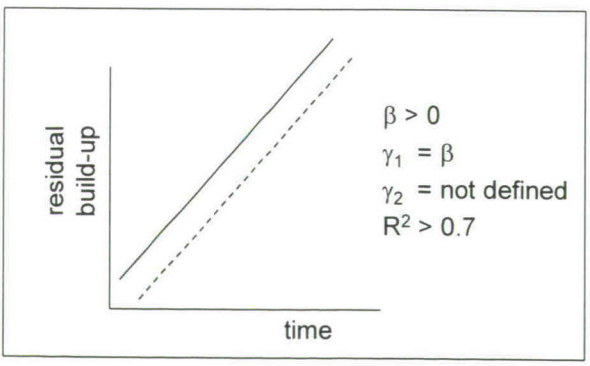


Figure 7.25: Stable continuous build-up

Stable continuous build-up occurs due to a positive development in the overall residual build-up and a high correlation between the data and the linear regression line.

- Radical build-up

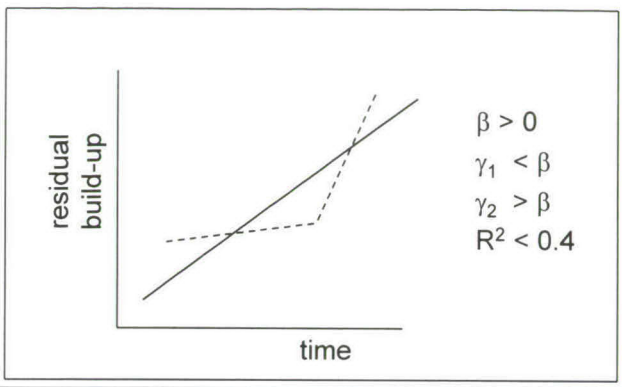


Figure 7.26: Radical build-up

A radical build-up occurs when the overall positive development is followed by a period of even greater development in the build-up of residual value. The low correlation implies that the last period has a major impact on the development of residual value.

Radical innovation is defined as changes related to both ends of the spectrum (Figure 7.22) and includes radical build-up; moderate build-up; moderate continuous build-up; unstable continuous build-up; radical tear down; unstable continuous tear down; moderate tear down and moderate continuous tear down. By taking only the extremes of the spectrum, which includes only radical build-up and radical tear down, the definition becomes 'strict radical innovation'.

In Figure 7.27 is a graph showing the development of the residual value of Aalberts Industries N.V. Besides the data, the linear regression line and the periods have also been plotted. The correlation, beta and the periods are also provided. Given these variables the build-up in residual value of Aalberts may be defined as stable damped build-up.

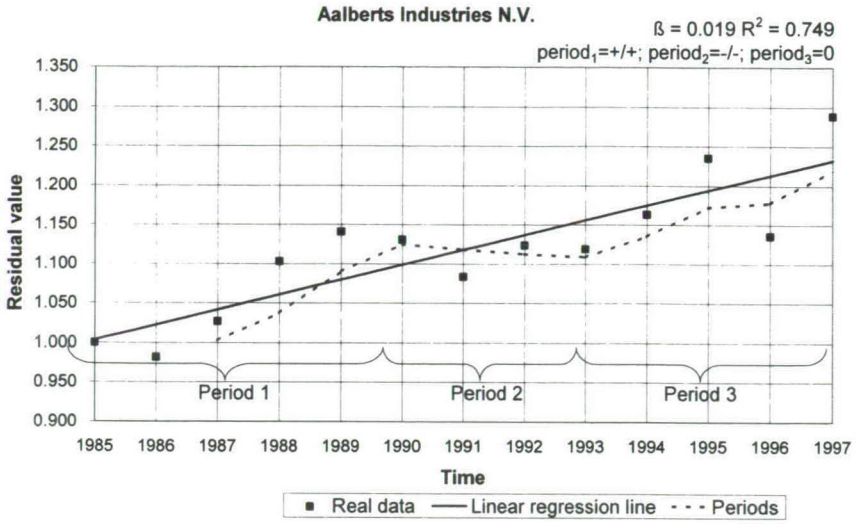


Figure 7.27: Aalberts Industries N.V.

7.4 Examples of the models in operation

7.4.1 Applying the model to analyse exploitation

ACF Holding N.V. (1985 – 1997): a focus on efficiency

ACF Holding NV (ACF) is a holding company for subsidiaries which market and distribute mainly healthcare products and services.

In 1990 ACF intended to merge with Gist-Brocades to fully exploit their joint venture Brocacef. After this merger failed ACF became the sole owner of Brocacef. This acquisition forced ACF to rethink its strategy with regard to the activities of the Brocacef holding, namely service provision, marketing and distribution of products in the healthcare sector.

New government regulations in the period 1994 to 1997 meant that ACF had to drop its prices and saw a reduction in the volume of its markets. As a result ACF was forced to carry out restructuring programmes and disinvest in non-core business.

It is remarkable that throughout the period 1994-1997 ACF continually reorganised and restructured to maintain its position in the market. These activities were all triggered by external factors. An analysis of its annual reports shows that the focus on cost reduction and efficiency was a continuous process throughout that period. This continual drive is best expressed by ACF's statement in its 1996 annual report:

> *'The market is in a transition phase due to government measures. Based on our position in the industry we need to achieve the lowest possible costs.'*

Based on its annual reports, ACF can be defined as efficiency driven (Figure 7.28 and Figure 7.29). The focus on efficiency was the result of developments in the healthcare sector, primarily new government regulation. It is not yet known whether ACF has been able to continue to improve its level of efficiency or keep up its level of added value as result of developing and selling products and services which are more unique.

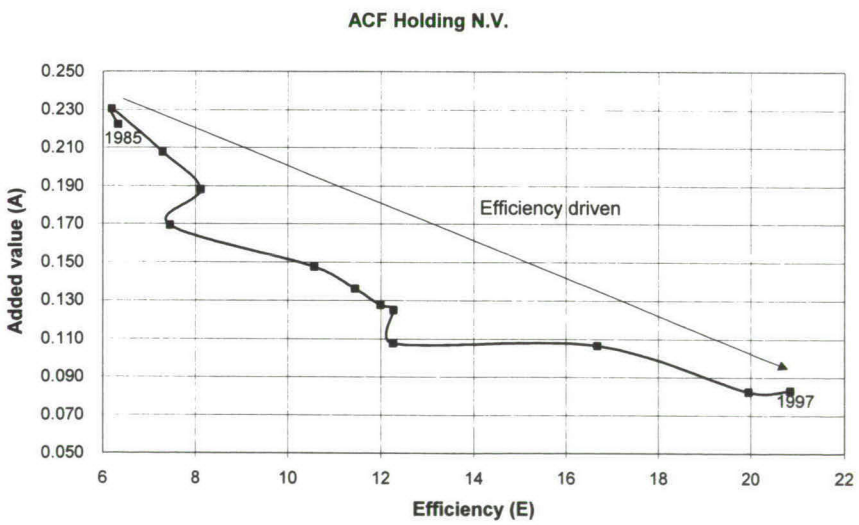


Figure 7.28: Efficiency versus added value ACF Holding N.V.

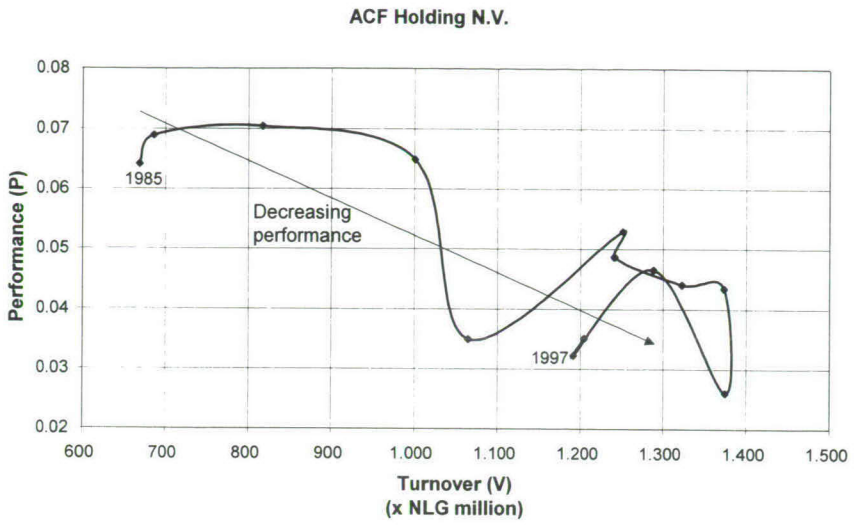


Figure 7.29: Volume versus performance ACF Holding N.V.

Getronics N.V. (1985 – 1997): a focus on volume

Getronics N.V. (Getronics) based in Amsterdam is a group of complementary business units operating in specific areas of information technology and telecommunications. The company is one of the largest providers of information technology products and services in the Netherlands and in Europe.

Getronics is an ambitious company: throughout the period analysed it was its stated aim to increase the level of turnover above market growth (Figure 7.30 and Figure 7.31). A strict focus on volume normally makes a company sensitive to the economic conditions. The recession in the IT industry in the early nineties hit Getronics hard and Getronics also reported that falling prices of the hardware in which it traded as a wholesaler as well as its poor earnings from complex projects, had caused its operational profits to drop.

With the change in the economic conditions and growing experience in the management of complex projects Getronics saw a strong growth in turnover and an improvement in its performance in the period 1994-1997.

However, the performance did not rise above the level before the downturn. In 1997 the level was still beneath that of 1992. There are three potential reasons for this:

- The fall in hardware prices was the main reason for the drop in performance in the early nineties. If this was the case, in this period at least, Getronics could be seen as a wholesale company.

- The ability to manage complex projects. which were now defined as its core business was not yet fully functional. This would imply that successful project management will improve the performance level of the company dramatically, or this strategy would be bound to fail.

- The growth in turnover demanded a disproportionate level of management attention. The focus on volume might be important to establish market dominance and economies of scale.
  However, a change towards efficiency or added value will be essential once market dominance has been established.

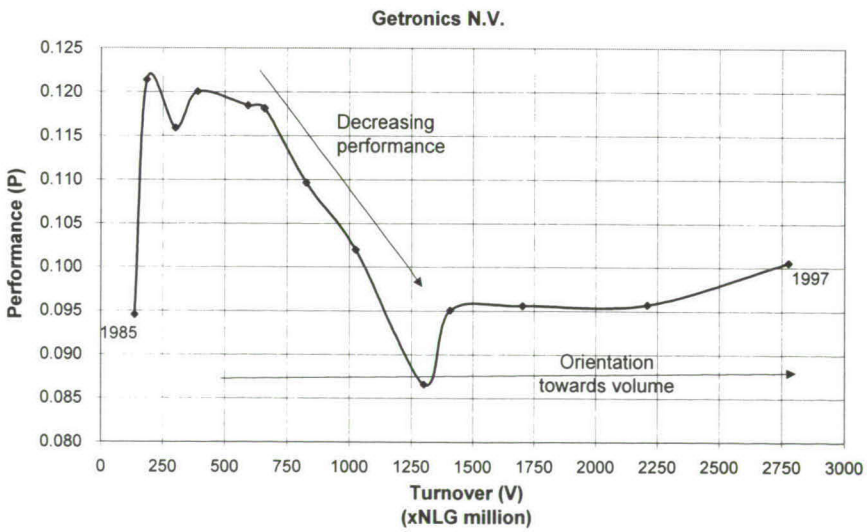


Figure 7.30: Volume versus performance Getronics N.V.

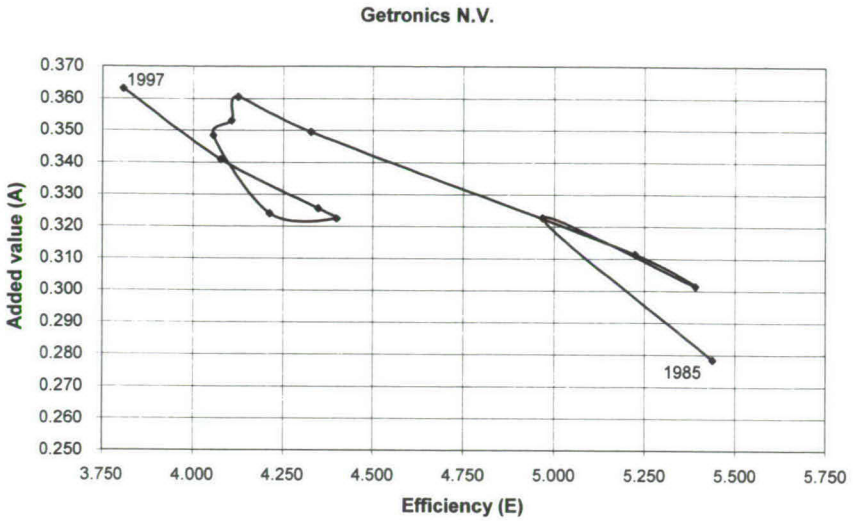


Figure 7.31: Efficiency versus added value Getronics N.V.

Philips Electronics N.V. (1985 – 1997): the absence of focus

Philips Electronics N.V. (Philips) is a multinational group of companies active in the development, manufacture, trade and distribution of electronic consumer goods, components, lamps and related products as well as products for the communications, medical and automotive industries. As a result of fierce global competition is Philips the only remaining European manufacturer of consumer electronics.

It is remarkable to observe that the performance or cash flow by turnover dropped dramatically in 1990 and in 1996. Both drops can be related to provisions made for major restructuring programs as well as a change of president.

By eliminating these provisions the average development of Philips could be categorised as efficiency driven (Figure 7.32 and Figure 7.33), but based on the definitions Philips cannot be categorised. The restructuring programs introduced by Timmer and Boonstra do indeed have a major efficiency focus: while Timmer's plan focused on increasing profitability and a sound balance sheet through lay-offs and divestment, Boonstra's restructuring programs focused on restructuring the portfolio.

The initial ambition formulated by Timmer seems to have been achieved given the now healthy balance sheet and excessive 'war chest', such that a new strategic direction is expected. No clear strategy can be discerned in the annual reports and its statements on strategy or ambition. The company continually restructures, invests and divests. A strategic direction how this is applied to operational activities may be available, but has not been published.

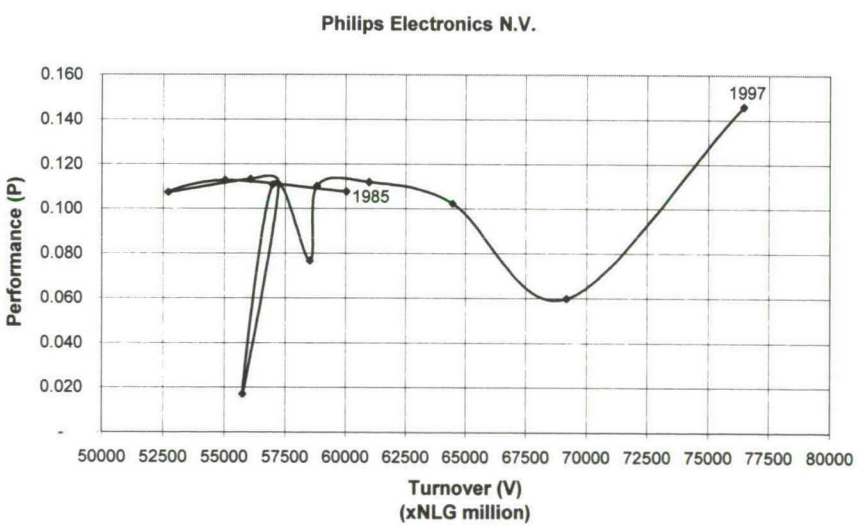


Figure 7.32: Volume versus performance Philips Electronic N.V.

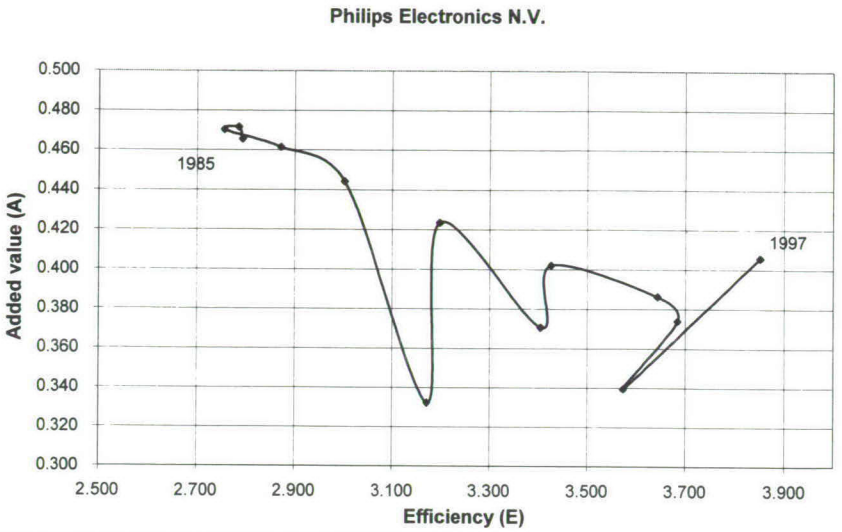


Figure 7.33: Efficiency versus added value Philips Electronics N.V.

Wolters-Kluwer N.V. (1986 - 1997): a focus on added value

Wolters-Kluwer N.V. (Wolters) is an internationally operating publishing group with subsidiaries throughout Europe and the United States. The company focuses on a number of core activities within specific market segments, such as business publishing, legal and tax publishing, educational publishing and medical publishing.

In 1985 Wolters' ambition was a turnover of NLG 1 billion in 1990. The merger of the Wolters Samson Group with Kluwer in 1987 created a new company with a turnover which was already in excess of NLG 1 billion. Over the following years Wolters maintained a high growth rate through numerous acquisitions. The selection criteria for this were the preference for strong positions in specialised markets such as professional, scientific and educational publishing.

In 1996 there was exceptional growth in turnover due to the acquisition of CCH. These selection criteria were based on Wolters' ambition to gain from high added value activities in niche markets. This ambition is formulated in its annual report of 1996 as '*Creating value for professionals*'.

Wolters offers its information products not only in the form of books periodicals and trade journals, but also in the form of newsletters, databases, electronic libraries, diskette publications, CD-ROM products and on-line services. The company is a leading legal publisher in Europe with a strong market position in many EC countries.

It seems that Wolters shifted its operational activities from its normal publishing business towards providing specialised and knowledge-related information products. As a result, due to the concept of knowledge, Wolters is able to achieve higher added value by turnover. Therefore, Wolters can be defined as an added value-driven company (Figure 7.34 and Figure 7.35).

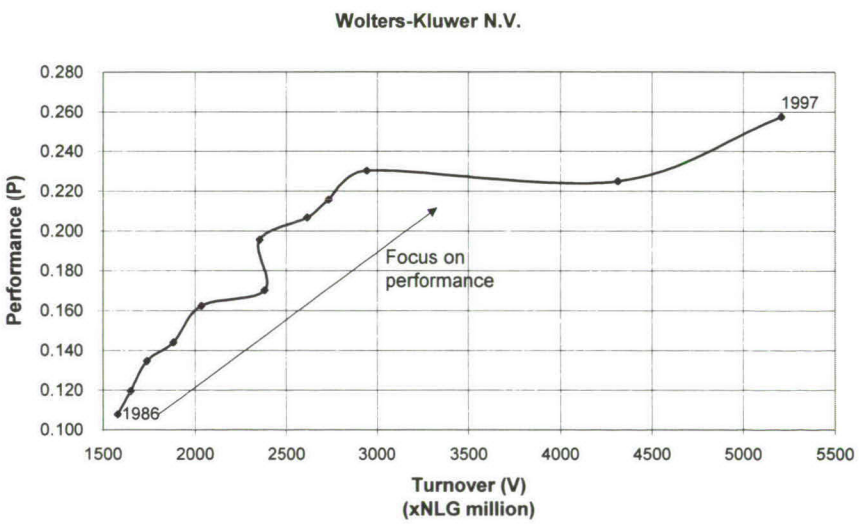


Figure 7.34: Volume versus performance Wolters-Kluwer N.V.

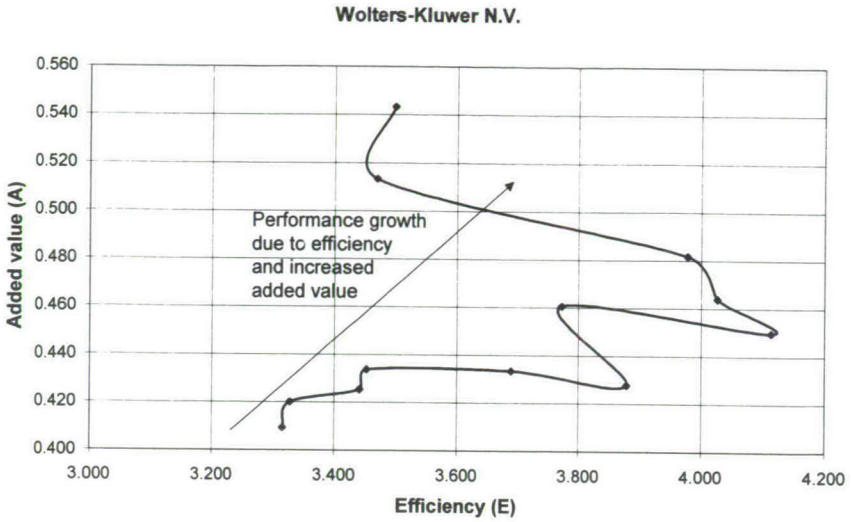


Figure 7.35: Efficiency versus added value Wolters-Kluwer N.V.

7.4.2 Applying the model to analyse exploration

NBM-Amstelland NV (1985 – 1997): a stable continuous build-up

With a turnover of NLG 4 billion NBM-Amstelland NV (NBM) is one of the major construction companies active in the field of building, infrastructure projects and the manufacture and trading of building-materials in the Netherlands. In the period analysed between 1985-1997 the company invested and divested heavily. Its aim was to grow and reduce risks while focusing on efficiency through economies of scale. This resulted in a growth in turnover from NLG 0.5 billion in 1985 to NLG 4 billion in 1997. The management recognised the focus on price competition that dominates this market which is sensitive to the prevailing conditions. Besides these responses, project management, product development and environmental issues were also addressed to avoid competing on price as the only factor. Apart from NMB's portfolio and growth in size, no structural changes in either the company's perspective or its the aim or mission were observed. This does not mean that the company did not change: as a result of incremental innovation NBM can be categorised as an efficiency-driven company. The stability of the company's

perspective can also be found by analysing the residual build-up. The real data, linear regression line and periods or residual build-up are plotted in Figure 7.36. The correlation between the average residual build-up and the linear regression line is 96%. No period breaks were identified and the beta is positive. Therefore, NBM-Amstelland N.V. has a stable continuous build-up.

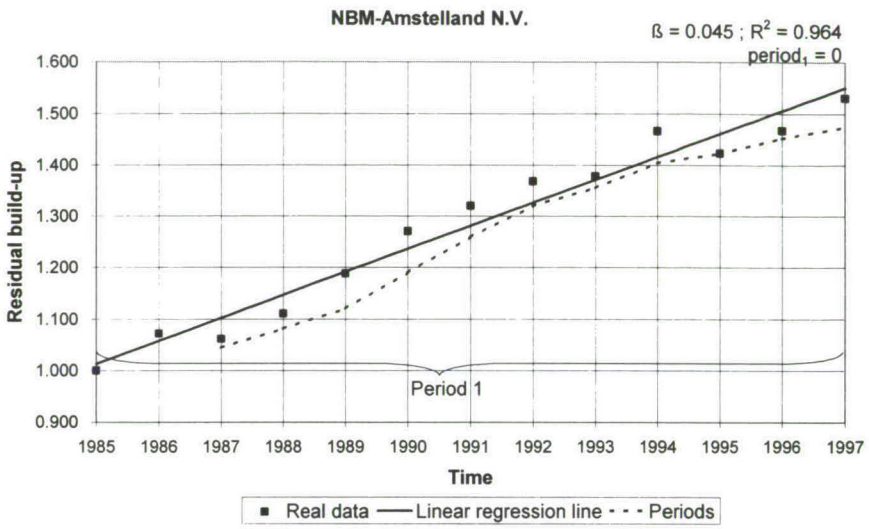


Figure 7.36: NBM-Amstelland: residual build-up

NV Koninklijke Bijenkorf Beheer (1985 – 1997): a radical tear down

NV Koninklijke Bijenkorf Beheer (KBB) is a retail consortium with several chains (Hema, Bijenkorf, Maxis, Praxis) and is mainly active in the Netherlands. Recovering from a difficult time in the early eighties, KBB invested to expand its operations. These investments were oriented towards customer focus and increasing flexibility. By expanding the number of chains KBB expected to be less dependent on the ever increasing change in consumer demands. By introducing new methods to provide more rapid insight into its clients' preferences and combining these findings with a higher frequency of ordering and delivery from suppliers KBB increased its flexibility. Despite the poor economic conditions in 1993 and 1994 KBB, was able to expand its market position and acquire new chains.

The stabilisation in the financial results, which started in 1995 was presented as a difficulty in coping with the increasing fluctuation in consumer demand. However, this trend was already identified by KBB in 1991. Therefore, it must be concluded that the company was unable to define sufficient measures or take these steps to respond to this generic trend. The annual reports from 1995 to 1997 focused on measures related to changes in the organisational structure of KBB; no changes in the company's perspective were defined or foreseen. KBB concluded that the decline in its financial position was due to the circumstances or temporary and not related to the company's perspective.

The residual build-up of KBB is presented in Figure 7.37, based on the negative beta and the fact that two periods can be discerned. Because the last period is negative and the previous period positive the residual build-up of KBB can be defined as a radical tear down. Based on the quantitative analysis it must be concluded that the perspective of KBB changed or the existing perspective did not change and became insufficient or even obsolete. Given the brief qualitative analysis based on the annual reports of KBB, the last argument would appear to be most likely.

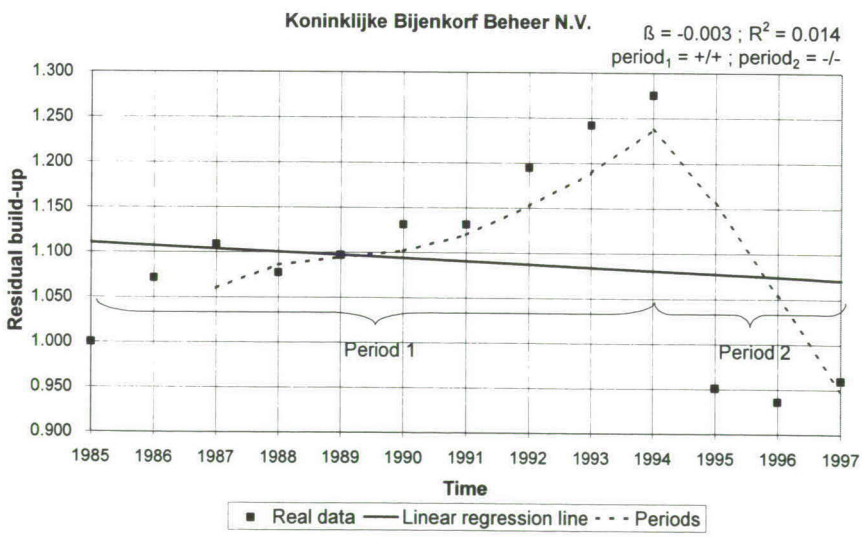


Figure 7.37: N.V. Koninklijke Bijenkorf Beheer: residual build-up

Koninklijke Ahold N.V. (1985 – 1997): moderate build-up

Royal Ahold N.V. (Ahold) is a global food retailer established in 1887. It started as a family business in the Netherlands. Ahold internationalised in 1977 and has since built up a strong presence on the East Coast of the United States. In the period 1985-1990 Ahold had a diverse portfolio of activities such as food retailing, restaurants, health and beauty chains. As a result of the increase in the number of acquisitions and the aim to integrate these acquired companies through centralisation, costs increased dramatically. In 1988 this development led not only to pressure to lower overhead costs, but also raised fundamental questions regarding the definition of the company's core business, from what perspective to grow and how to integrate the companies to be acquired.

These discussions and studies resulted in a new definition of the core business. which was published in the annual report of 1989. From then on Ahold would concentrate on '*the distribution of goods to the consumer*'. As a result the AC restaurants and recreational facilities were sold off to their managements. Secondly, Ahold decided to expand internationally and concluded that a decentralised structure would be most suitable.

The core business defined in 1989 evolved over time. In 1993 Ahold sharpened the definition of the core business and formulated the strategic aim '*to maintain an innovative profitable and by customer preferred role well into the future*'. In 1994 Ahold stated that its main efforts would be concentrated on '*innovation and adding value to the customer*'. By introducing a wide range of innovative new products, such as fresh, ready-to-serve meals, services such as electronic payment systems and extending the opening hours of its stores in the Netherlands Ahold operationalised its claim '*to put the customer first*' (1997).

Ahold's already strong market position in the USA was further strengthened by the acquisition of Tops Markets at the beginning of 1991 and Red Food Stores in 1993. Besides in the USA companies were also acquired in Europe, South America and Asia. The definition of the core business published in 1989 changed the company's perspective from a diverse national company with

subsidiaries abroad into a company concentrating on food retailing and its ambition to be recognised as the '*best food retailer in the world*'.

Figure 7.38 shows Ahold's build-up in residual value. The period of diversification in the early period hampered the build-up of residual value. Ahold's change of mission and ambition since 1989 can be seen in this figure; the second period is defined as neutral to positive, which demonstrates that the new focus on quality and loyalty enabled Ahold to regain its upward trend. Based on these findings, Ahold can be categorised as a company with a moderate build-up in residual value.

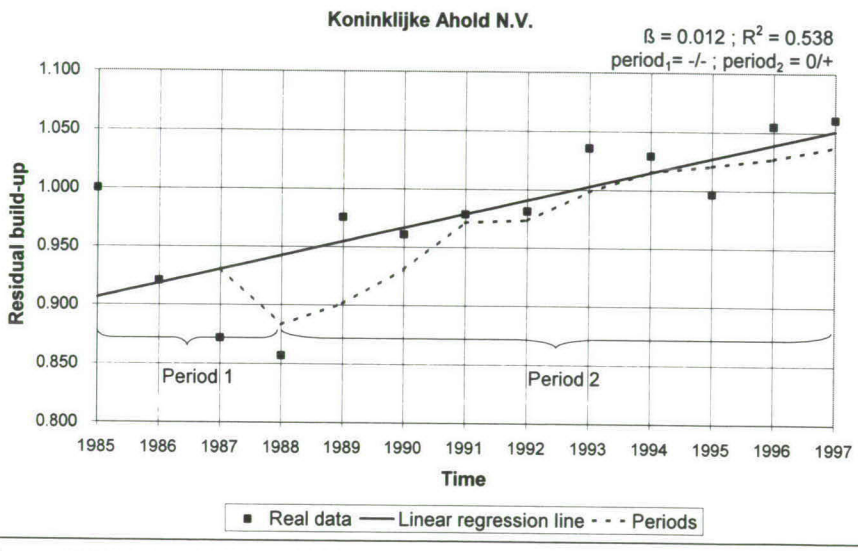


Figure 7.38: Koninklijke Ahold N.V.: residual build-up

7.4.3 Applying the models to analyse exploitation and exploration

Royal Nedlloyd N.V. (1985 – 1997): the absence of focus and an unstable continuous build-up

In the early eighties Royal Nedlloyd N.V. (Nedlloyd), a large logistics group with its home base in the Netherlands, found itself operating in a market with over-capacity and falling prices. It was expected that cost reductions and other efficiency measures would not be sufficient to stop the cash drain due to falling

prices and reduced margin. Most of its operational activities involved the exploitation of shipping and sea-lines throughout the world. These activities accounted for more than half of the company's turnover and assets. The company expected that the then overcapacity would not be resolved soon and developed a strategy to reduce competitive pressure by developing the concept of a coherent set of various logistical products and services. This strategy was initially defined in the first half of the eighties by the then CEO, Rootlieb.

This strategy would transform the company from a capacity provider mainly active in shipping into a company with a focus on international logistics in general. The deployment of this strategy aimed at value added logistics would decrease the level of assets related to the sea-line activities and would ultimately increase the level of turnover and assets related to land-based activities. Nedlloyd thought that it had all the facilities necessary to successfully implement this new strategy due to its excellent reputation, sound financial basis, advanced telecommunication facilities, experienced staff and sufficient knowledge of the different products and services.

By simultaneously undertaking efficiency measures in the area of its shipping activities and developing and buying companies active in warehousing and distribution on a European scale, the company started to change, as can be seen in Figure 7.39 and Figure 7.40 where the initial development is oriented towards the development of added value. Financially, the initial results became visible in 1985-1986; value added logistics became a more prominent part of the operational activities of the company. However it was found that the in-house knowledge about specific products and services was not sufficient. The strategy could only work if these products and services could be linked to one another. This required skills and related knowledge that was not yet available and had to be developed. Developing and deploying these capabilities as a result of the new perspective or strategy defined by Rootlieb took longer than expected. A gap became visible: the financial results that were needed to solve the declining income from the shipping activities lagged behind and the company's overall result stagnated.

One of the shareholders, Hagen, questioned the new perspective of the company and a battle began about the correct perspective of the company.

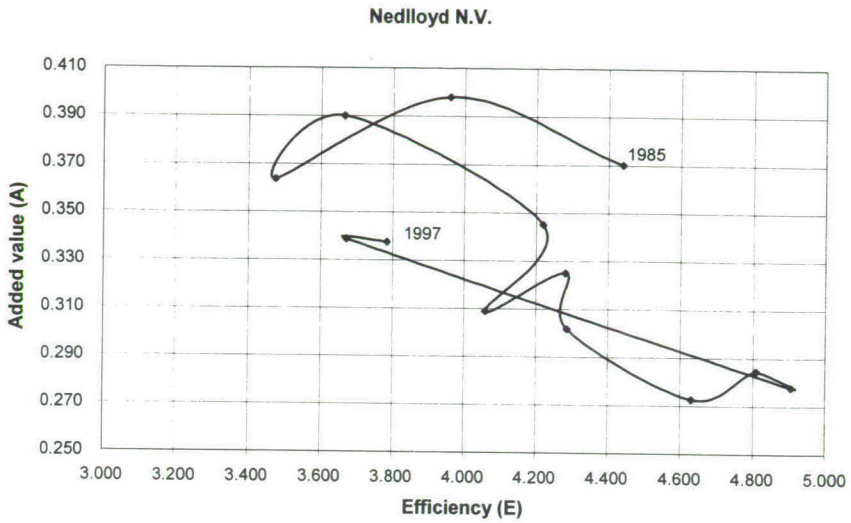


Figure 7.39: Efficiency versus added value Royal Nedlloyd N.V.

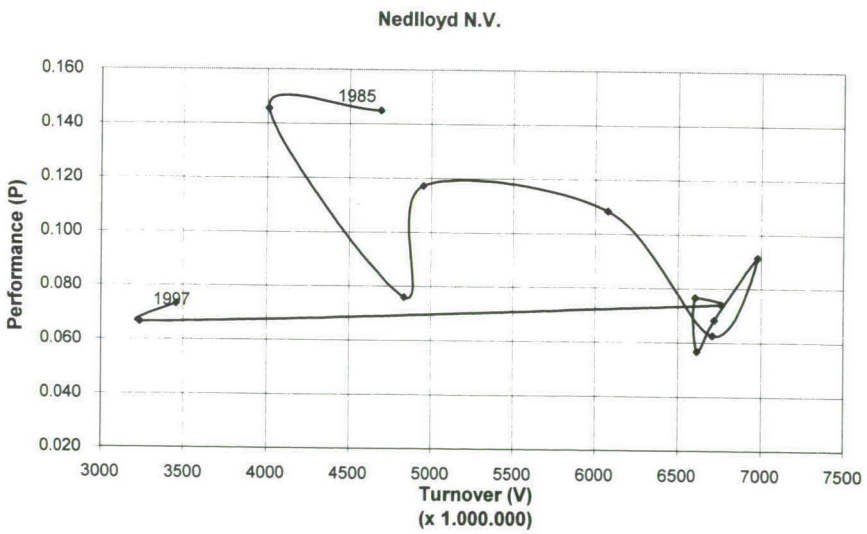


Figure 7.40: Volume versus performance Royal Nedlloyd N.V.

Hagen stated that Nedlloyd should keep its focus on its shipping activities while Rootlieb wanted to stick to his strategy of value added logistics. In the

years that followed Rootlieb was unable to deploy his strategy any further. Probably due to the fierce battle with Hagen, the lack of direct results from value added logistics, the inter-relatedness of these two and the lack of confidence by investors, Nedlloyd was forced to abandon its strategy. As a result the company was unable to maintain its neutral second period.

Following the neutral second period which lasted from 1990-1995, the final years showed a tear down of residual or a negative period.

The new CEO, Berndsen who arrived in 1993, focused on creating shareholder value to regain the trust of the Nedlloyd shareholders but did not come up with a new strategy for the company. Berndsen concluded that Nedlloyd was too small for its shipping activities and that the synergy between the distribution activities and the shipping activities was minimal. Berndsen followed the analysis by Rootlieb, however his conclusions were the opposite: the shipping activities were merged with P&O (1996) to create a new company to obtain economies of scale.

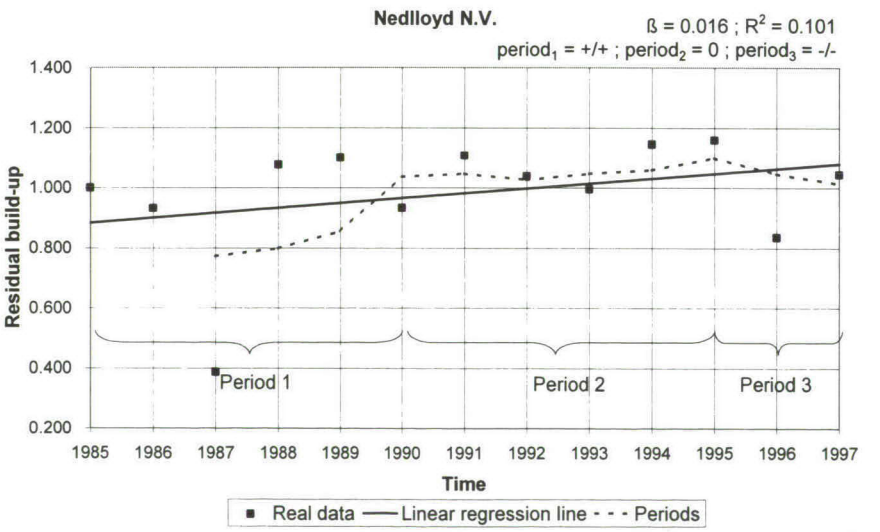


Figure 7.41: Royal Nedlloyd N.V.: residual build-up

The measures taken by Berndsen did not result in a new operational strategy for the company as a whole; resource productivity (Figure 7.41) did not change in the nineties. A decrease in turnover in 1999 due to the merger with P&O and

a tear down in residual value since 1996 did not change the perspective of the company positively.

Due to the overall overcapacity Nedlloyd had to change its strategy in the eighties. It remains unclear whether the strategy aimed at added value logistics would have been successful if the necessary skills could have been developed in a shorter period of time. After several years the strategy had to be abandoned. The absence of growth in the total resource productivity since the early nineties implies that Nedlloyd did not change its perspective and that under the existing perspective, no new resources were developed and successfully deployed.

7.5 Empirical results

7.5.1 Results of the exploitation analyses

Based on the algorithm provided in section 7.2 and the defined hurdles (Figure 7.42), 49 companies (58%) changed their focus on the process of production and value creation and are categorised as incremental innovation companies (Figure 7.43).

Defaults for incremental innovation	
- Number of companies	85
- Number of data points	1082
- Hurdles	
Consistency (c)	
Volume	0.09
Efficiency	0.00
Differentiation	0.00
Cash impact (i)	0.50
Consistency and cash impact (ci)	0.50

Figure 7.42: Defaults for exploitation

The normalised operational cash flow per category per variable is presented in Figure 7.44.

Level of categorisation	
- Incremental innovation	49 (58%)
- Stable focus	36 (42%)
- Volume	13 (15%)
- Efficiency	6 (7%)
- Added value	17 (19%)
- Total	85 (100%)

Figure 7.43: Level of categorisation

Development of normalised operational cash flow and categorisation						
	Total OCF	Differentiated by generic components				
		Volume	Significance	Efficiency	Significance	Added value	Significance
- Incremental innovation	0.733	0.637		0.115		- 0.020	
- Stable focus	0.817	0.682		0.029		0.106	
- Volume	0.745	0.840	0.025**	0.030		-0.125	
- Efficiency	0.601	0.575		0.262	0.311	-0.237	
- Added value	0.949	0.595		- 0.054		0.404	0.030**
- Total	0.768	0.656		0.079		0.034	

** Significance at 95% level per generic component

Figure 7.44: Development of operational cash flow and categorisation

Based on the typology provided in Annex E, by size and industry, the categorisation is also related to size (Figure 7.45) and industry (Figure 7.46).

Categorisation by size				
	Total	Differentiated by size		
		AEX	Midcap	Smallcap
- Incremental innovation	49 (58%)	9 (53%)	7 (54%)	33 (60%)
- Stable focus	36 (42%)	8 (47%)	6 (46%)	22 (40%)
- Volume	13 (15%)	2 (12%)	2 (15%)	9 (16%)
- Efficiency	6 (7%)	1 (6%)	1 (8%)	4 (7%)
- Added value	17 (20%)	5 (29%)	3 (23%)	9 (16%)
- Total	85 (100%)	17 (100%)	13 (100%)	55 (100%)

Figure 7.45: Categorisation by size

Categorisation by industry				
	Total	Differentiated by size		
		Physical production	Distribution and communication	Services
- Incremental innovation	49 (58%)	25 (64%)	13 (52%)	11 (52%)
- Stable focus	36 (42%)	14 (36%)	12 (48%)	10 (48%)
- Volume	13 (15%)	6 (15%)	2 (8%)	5 (24%)
- Efficiency	6 (7%)	3 (8%)	2 (8%)	1 (5%)
- Added value	17 (20%)	5 (13%)	8 (32%)	4 (19%)
- Total	85 (100%)	39 (100%)	25 (100%)	21 (100%)

Figure 7.46: Categorisation by industry

Based on the findings it can be concluded that a volume and an added value oriented strategy has a significantly different structure of operational cash flow components than the other generic strategies. Secondly, a certain relationship between size and industry type and the deployment of one of the generic strategies can be detected; large companies active in relative older industries have a more stable focus than small companies within young industries.

7.5.2 Results of the exploration analyses

Using the algorithm for radical innovation presented in section 7.3 and the hurdles or boundaries defined (Figure 7.47) the 85 companies can be categorised (Figure 7.48).

Default settings for radical innovation	
Number of companies	85
Number of data points	1082
Hurdles	
Beta	< 0
	> 0
R1	< 0.4
	0.4 < ^ < 0.7
	> 0.7
Period	-/- → +/+

Figure 7.47: Default settings for exploration

	Negative Beta (Beta < 0)			Positive Beta (Beta > 0)			
	Low (R^2<0.4)	Medium (0.4<R^2<0.7)	High (R^2>0.7)	High (R^2>0.7)	Medium (0.4<R^2<0.7)	Low (R^2<0.4)	
Positive break	4	0	0	1	6	2	*13*
Neutral break	2	1	0	24	4	4	*35*
Negative break	2	1	0	18	13	3	*37*
	8	*2*	*0*	*43*	*23*	*9*	*85*
	10			*75*			

Figure 7.48: Level of categorisation

The categorisation of radical innovation presented here is specific to size and industry (Figure 7.49 and Figure 7.50).

Categorisation by size				
	Total	Differentiated by size		
		AEX	Midcap	Smallcap
- Radical innovation	22 (26%)	4 (24%)	1 (8%)	17 (31%)
-Strict definition	4 (5%)	0 (0%)	0 (0%)	4 (7%)
- Stable build-up	63 (74%)	13 (76%)	12 (92%)	38 (69%)
-Total	85 (100%)	17 (100%)	13 (100%)	55 (100%)

Figure 7.49: Categorisation by size

Given these findings it can be concluded that the occurrence of radical innovation is limited. Only 22 out of 85 companies (26%) realised a radical innovation during the analysed period. Through extrapolation it can be concluded that the average period of exploration stability is much higher than the period of exploitation stability.

Categorisation by industry				
	Total	Differentiated by industry		
		Physical production	Distribution and communication	Services
- Radical innovation	22 (26%)	7 (18%)	7 (28%)	8 (38%)
- Strict definition	4 (5%)	0 (0%)	2 (8%)	2 (10%)
- Stable build-up	63 (74%)	32 (82%)	18 (72%)	13 (62%)
- Total	85 (100%)	39 (100%)	25 (100%)	21 (100%)

Figure 7.50: Categorisation by industry

7.5.3 Combined results: exploitation and exploration

Based on the findings about incremental innovation and radical innovation these two can be combined. In Figure 7.51 the categorisation of incremental innovation is combined with the findings about radical innovation.

Combined results: exploitation and exploration			
	Total	Incremental innovation	
- Radical innovation	22 (26%)	15 (31%)	
- Strict definition	4 (5%)	4 (8%)	
- Stable build-up	63 (74%)	34 (69%)	
- Total	85 (100%)	49 (100%)	
	Volume	Efficiency	Added value
- Radical innovation	4 (31%)	0 (0%)	3 (18%)
- Strict definition	0 (0%)	0 (0%)	0 (0%)
- Stable build-up	9 (69%)	6 (100%)	14 (82%)
- Total	13 (100%)	6 (100%)	17 (100%)

Figure 7.51: Combined results

7.6 Validation

7.6.1 Introduction

Before any conclusions can be drawn, the findings based on the quantitative analysis must be validated. This validation covers several aspects such as an analysis of the impact of the defined hurdles on the proposed framework, a qualitative validation based on several of the quantitatively categorised companies and a quantitative validation through the use of a different data set.

The justification of the categorisation by exploitation and exploration will be validated through analysing qualitative statements published in the annual reports of several companies and comparing these with the findings of the quantitative categorisation of incremental and radical innovation (sections 7.6.4 and 7.6.5). To ensure an objective interpretation of the qualitative statements a Delphi study is made.

A second, more technical validation of the framework focuses on the impact of the defined hurdles in relation to the level of categorisation. By altering the defined hurdles and boundaries the strictness and impact of the mathematical boundaries on both exploitation and exploration and will be tested in sections 7.6.2 and 7.6.3.

The last analysis that completes the validation protocol is the execution of a quantitative analysis identical to those described in sections 7.2 and 7.3, however using a different data set (section 7.6.6). The chosen data set is derived from companies listed on the New York Stock Exchange (NYSE). This data set is chosen as it combines the availability of data and the need to overcome the bias of cultural differences; if the findings between companies listed in Amsterdam and New-York are comparable it is assumed that the initial data set has no specific bias other than that both data sets solely represent companies which are publicly traded. This bias cannot be resolved due to the lack of data of private companies. However it is assumed that this bias has a minimal impact on the overall findings. The developed framework is only then useful if the impact of the defined hurdles is minimal and the qualitative findings based on categorisation match the quantitative findings and the different data sets generate comparable findings.

7.6.2 Altering hurdles and the impact on the level of categorisation on exploitation

The consistency hurdles are defined to measure year-to-year developments related to the different variables. The efficiency and added value variables are related to a single unit of turnover and a positive development of these ratios leads to a Boolean value of '1'. As presented in this Chapter the year-to-year volume development should be above the level of 9% to lead to a Boolean value of '1'. The cash impact hurdle (Figure 7.7) for both volume and performance is exclusive and related to the development of the operational cashflow. Exclusivity can only be obtained with a hurdle of 0.5. The cash impact hurdle on efficiency and added value is related to the cash impact of the performance which follows *equation 6.4*.

The hurdle based in the combination of consistency and cash impact is defined as 0.5 and implies that positive developments on both consistency and cash-impact should be recognised in at least half of the analysed years. The values of the hurdles or thresholds chosen in section 7.2 for consistency, impact and the combination of consistency and impact, α_c α_i and α_{ci} respectively, are logically consistent and there is no direct reason to deviate from the chosen default settings. However, it is necessary to investigate the impact on the number of categorised companies when the thresholds are increased. An analysis based on decreasing the hurdles is not considered since a decrease does not lead to exclusive categorisations.

In Figure 7.52 to Figure 7.54 the development of the number of companies that can be categorised as stable as a percentage of the total number of companies (y-axis) are plotted in relation to the increase, ceteris paribus, of $\alpha_{c(v)}$ and $\alpha_{c(e,a)}$, α_i and α_{ci} respectively. It can be concluded that for an increase in the defined hurdles towards a level of stable categorisation of 10%, $\alpha_{ci,}$ has to develop to 0.68 (36%); $\alpha_{c(v)}$ to 0.135 (50%); $\alpha_{c(e,a)}$ to 0.045 (45%) and α_i 1.2 (240%). As a result the hurdle based on the combination of consistency and cash impact has the greatest impact.

Based on the findings of increasing α_c α_i and $\alpha_{ci,}$ it must be concluded that, as expected, the chosen hurdles have a negative impact on the level of

categorisation and increase the number of companies that could be categorised as achieving incremental innovation. However a small deviation from the defined the hurdles does not have a major impact on the level of categorisation of the companies and therefore no argument is found to deviate from the defined default settings.

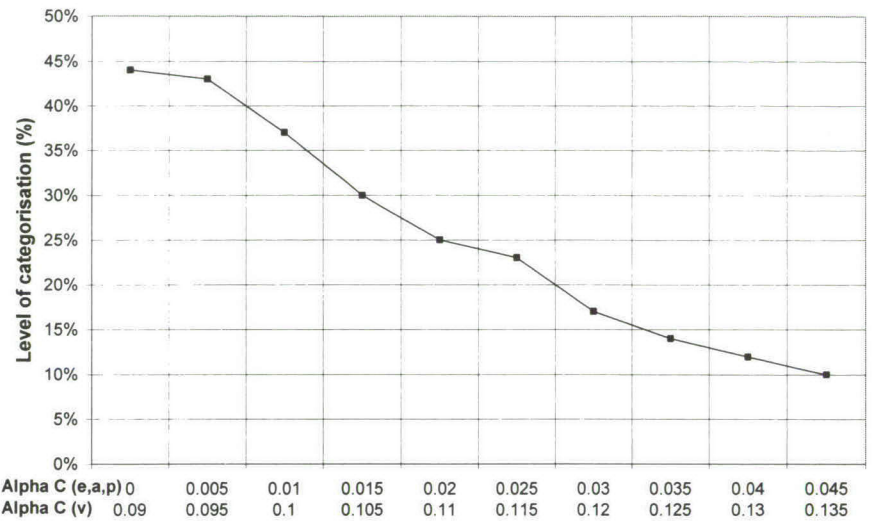


Figure 7.52: Increasing α_c and impact on the level of categorisation

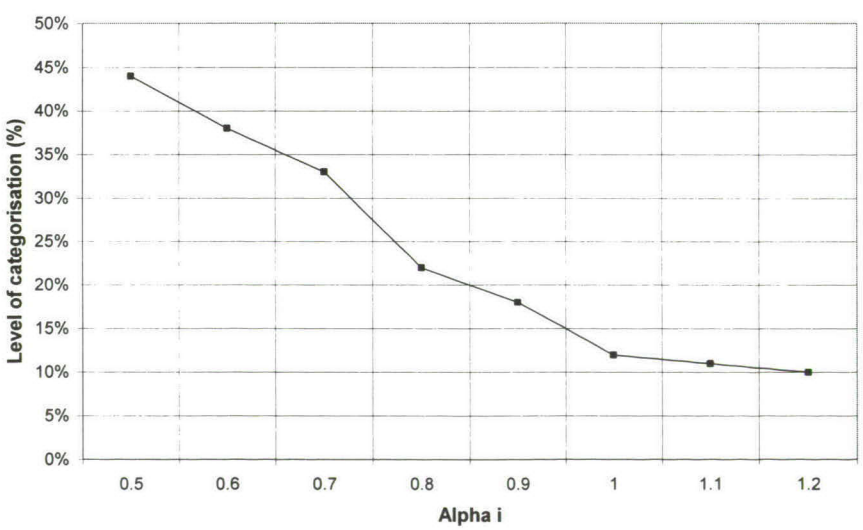


Figure 7.53: Increasing α_i and the impact on the level of categorisation

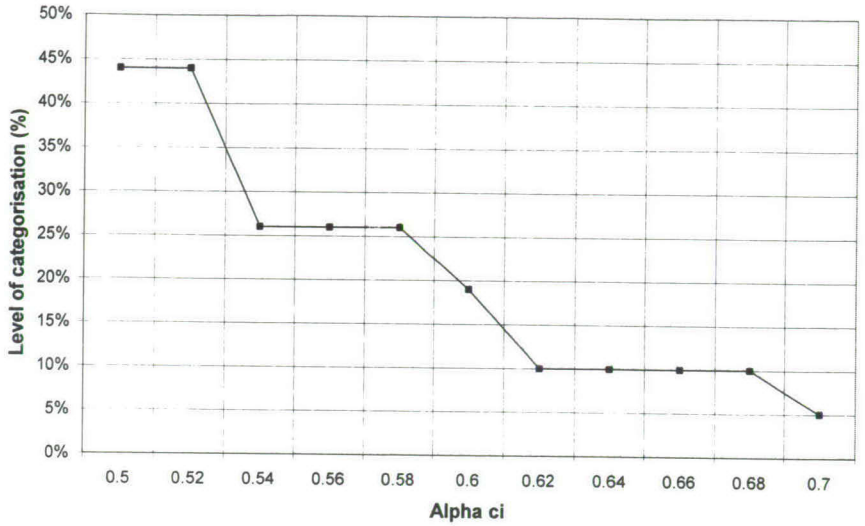


Figure 7.54: Increasing α_{ci} and impact on the level of categorisation

7.6.3 Altering hurdles and impact on the level of categorisation on exploration

In the analysis on exploration the correlation level is, however, congruent with the literature on statistics, arbitrary and actually implies two hurdles, namely for the definition of high correlation (default setting higher than 70%) and for the definition of low correlation (default setting below 40%). The correlation is related to the interpretation if the build-up of residual value is stable (higher than 70%), unstable (lower 40%) or moderately stable (between 40% and 70%). By alternating these hurdles a change in the number of companies per category occurs. The composition per category is illustrated in Figure 7.55 and Figure 7.56. The vertical line in each figure denotes the default setting for the respective hurdles. In both figures a turning point can be seen where middle and low and middle and high change places.

For the low-end hurdle this event occurs at 0.450 when 26% of the companies fall into the medium category and 27% can be categorised as low-end companies. When the high-end hurdle is set at 0.75, a similar change occurs.

Only now both categories, high and medium, hold the same percentage of companies, i.e. 39%. Based on these figures it must be concluded that the development of the categorisation related to the development of the hurdles is not discontinuous and as a result no reason is found to deviate from the default settings.

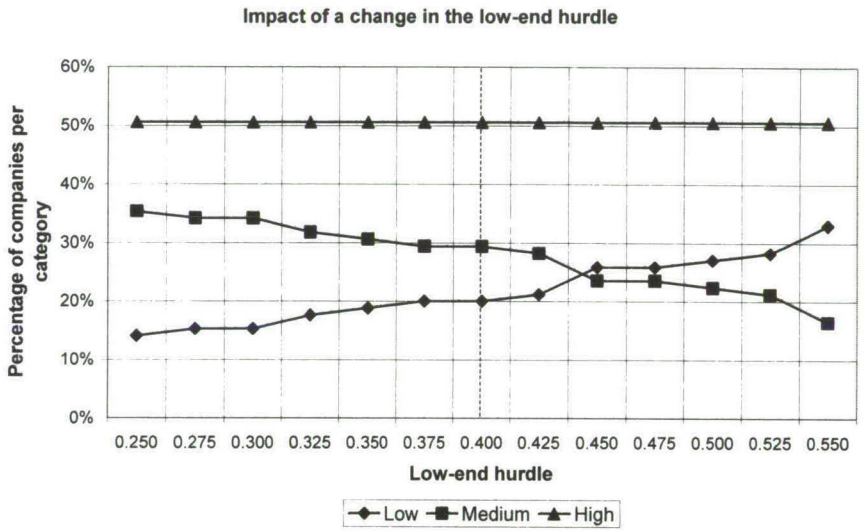


Figure 7.55: Low-end hurdle change

7.6.4 Delphi study of exploitation

The findings based on the proposed quantitative model are tested by means of a Delphi study. The annual reports of five companies were selected and all quotes related to the process of production and the process of value creation were noted, randomised and anonymised.

Based on this analysis 104 quotes are obtained. Five people, all of them unfamiliar with the findings based on the quantitative model and with a professional and wide ranging experience of analysing companies, were asked to categorise these quotes.

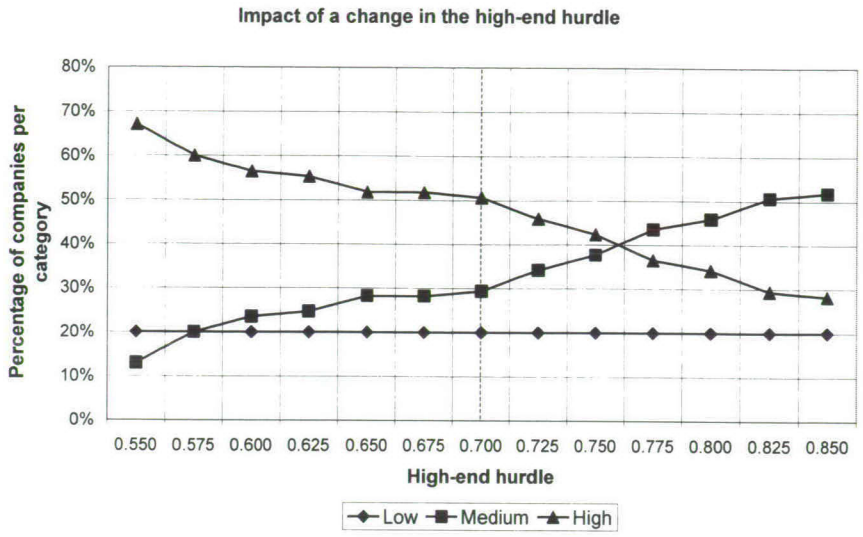


Figure 7.56: High end hurdle change

The categorisation consisted of four groups, i.e. volume, efficiency, added value and quotes that cannot be categorised in one of the previous groups. The number of categorisations were calculated per company and per category. Validation occurs when most of the categorisations per quote are similar among the five respondents and when the categorisation per company, based on the quantitative analysis per company, is similar to the categorisation based on the Delphi analysis.

Based on this analysis, 520 answers were obtained. In the first round of the Delphi study only nine answers differed (2%). Apart from the categorisation of Philips Electronics N.V., the categorisation based on the Delphi study is identical with the categorisation based on the quantitative analysis. In section 7.4.1 it was also stated that a small alteration of the cash impact hurdle would have categorised Philips Electronics N.V. as 'efficiency-driven'. Based on these findings (Figure 7.57), the quantitative model on exploitation is further strengthened.

	Sum of categorised quotes				Categorisation based on qualitative analysis	Categorisation based on quantitative analysis
	Volume	Efficiency	Added value	Incremental innovation		
ACF Holding N.V.	10	75	4	26	Efficiency	Efficiency
Getronics N.V.	50	15	20	15	Volume	Volume
Koninklijke Ahold n.v.	20	34	50	11	Added value	Added value
Philips Electronics N.V.	5	50	0	35	Efficiency	Incremental innovation
Wolters-Kluwer N.V.	25	0	49	26	Added value	Added value

Figure 7.57: Results of Delphi study of exploitation

7.6.5 Delphi study of exploration

In order to validate the quantitative findings on exploration the annual reports of four companies were selected and all quotes related to the company's perspective, mission, vision and the process of forming resources were noted. Groups of quotes from the annual reports per year (1985-1997) were obtained for each company. Six people were asked to participate in this Delphi study. Three were asked to analyse these quotes per company to detect stability and three were asked to analyse the same quotes to detect a certain change or development. All of the participants were unfamiliar with the quantitative model and its findings and all of them had a professional and wide-ranging background in analysing companies.

The Delphi study of stability and change matched the first Delphi study: similar results from both stability and change were found for the analysed companies (Figure 7.58). When these findings were compared with the findings of the quantitative analysis only Royal Nedlloyd N.V. differed. This can be explained by the fact that Royal Nedlloyd N.V. divested several of its operational activities and thus changed its perspective as a company but did not change its mission or vision of the business itself. Based on these findings the quantitative model on exploration is also further strengthened.

	Delphi based on stability of high order		Delphi based on change of high order		Conclusion based on qualitative analysis	Conclusion based on quantitative analysis
	When do changes occur	Overall	When do changes occur	Overall		
NBM Amstelland NV	-	Stable	-	Stable	Stable	Stable
NV Koninklijke Bijenkorf Beheer	1993 - 1995	Change	1993 - 1995	Change	Change	Change
Koninklijke Ahold N.V.	1988 - 1989	Change	1988 > 1989	Change	Change	Change
Royal Nedlloyd N.V.	1995 - 1996	Change	1995 - 1996	Change	Change	Stable

Figure 7.58: Results of Delphi study of exploration

7.6.6 Different data set

An analysis of the bias of the data set was made through the use of a different data set. Through 'World-scope' data from companies listed on the New-York Stock Exchange were derived, however sufficient data for the purpose of this analysis was only found for 279 companies. The analysis focused on the similarity of the findings per group. For this purpose the initial four groups were studied (Figure 2.6) and the findings per group based on the US data set is compared with the findings of the NL data set. In Figure 7.59 the US data set and the NL data set are compared. It can be concluded that the US-data set is not significantly different from the NL data set. It was also found that two segments produce a slightly similar significance (findings > 0.9). Based on these findings it can be concluded that the US data set does not differ significantly from the data set used in this study and therefore the model is further strengthened.

Based on the validation analyses no arguments are found to reject the developed framework.

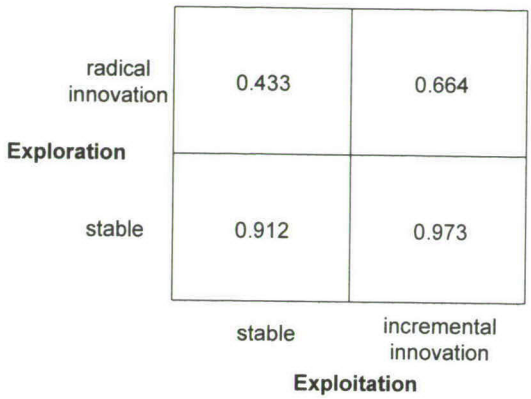


Figure 7.59: Two-sided p-value per group of the US data set, compared with the NL data set

7.7 Conclusions

This study focuses on the exploitation – exploration dilemma and uses an modified punctuated equilibrium paradigm to measure exploitation and exploration. Given the scope of the dilemma, companies have to balance exploitation and exploration and hence the framework should not exclude developments in a given time frame, but must allow for changes in both dimensions at the same time (Figure 7.60).

An empirical test was carried out to validate the proposed framework and used real data from 85 companies listed on the Amsterdam Stock Exchange. Based on the defined boundaries and limitations, the data sample was limited; the selected companies were listed for at least ten years or more. Before the empirical test was carried out an algorithm, based on the proposed framework, was developed.

7.7.1 Exploitation

Exploitation is related to the production process and the value creation process and can be analysed by using the company's value chain. As found in Chapter three several developments, such as JIT, BPR and TQM, can be related to a change in the organisation of the company's value chain.

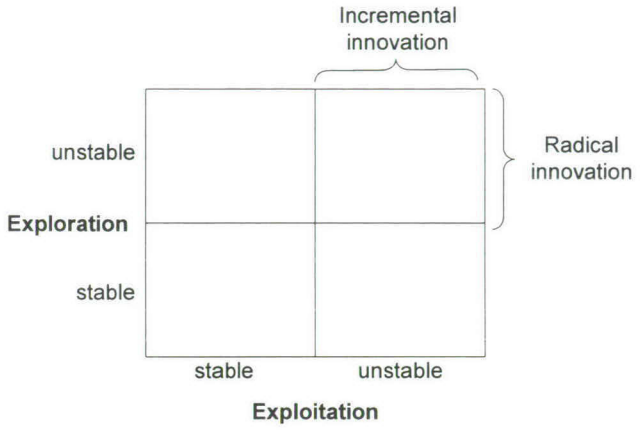


Figure 7.60: Innovation and stabiltiy

Incremental innovation means that companies change their orientation on how to organise their value chain. By coupling the variables to detect volume, efficiency and added value (as determinants of generic strategies) with the development of operational cash flow as the determinant of short-term success, both incremental innovation and the existence and success of generic strategies can be measured. By changing its generic strategy a company adopts a different focus on the processes of production and value creation. This change may be implicit or explicit, voluntary or forced. This study does not focus on the intention or reason for consistency or change but only on actual results and does not imply that companies with a focus strategy do not change. Based on the proposed model it is possible to determine whether incremental innovation occurred in each company and if, not what type of generic strategy has been adopted in relation to the production process and the operational value creation process.

Based on the findings, 58% (49 out of 85 companies) achieved incremental innovation and thus changed their focus on the organisation of their value chain in relation to the process of value creation. At the same time 42% (36 out of 85 companies) can be categorised as having a stable focus. This implies that in at least half of the years analysed, the value of the variable related to one particular generic strategy improved, and that at least half of the development of the operational cash flow can be traced to the development of that specific generic strategy. Based on the findings presented in Figure 7.43 and Figure 7.44 it may be concluded that consistency pays off: companies with a focus have a much higher development of operational cash flow than companies that changed their perspective. In this sense it is concluded that from the perspective of exploitation a deployment of a single generic strategy is more useful than incremental innovation. Secondly, it is also be concluded that the pay-off from a added value strategy is higher than the development of the operational cash flow of efficiency or volume-driven companies.

7.7.2 Exploration

Radical innovation is related to the change in the perspective of a company and the process of forming resources. By using endogenous growth theory (Solow, 1957) it is expected that the development of residual value, or intellectual capital, which cannot be related to one of the core stakeholders, will be stable for most companies. A change of perspective implies a different orientation towards existing or different core stakeholders and generic firm processes and results in a different build-up of residual value.

Radical innovation occurs when the direction of the residual build-up in a given period of time differs from the overall development and is contrary to the development in the previous period. Based on the three variables defined in section 7.3, a two-dimensional framework emerges (Figure 7.21) in which different levels of stability and radical innovation can be placed. In this framework two types of radical innovation can be seen:

- Companies categorised as having a strict radical build-up have a low correlation between the residual build-up and the linear regression line of the residual build-up. They also have an overall positive development of

the linear regression line and a break away from the linear regression line towards a more positive development.
Following this definition companies labelled as having a strict radical build-up in residual value show a positive development of their residual build-up and due to a change in perspective even increase the development of their residual build-up.

- Companies categorised as having a strict radical tear down have a low correlation between the residual build-up and the linear regression line of the residual build-up, an overall negative development of the linear regression line, and a break away from the linear regression line towards a more negative development. Following this definition companies labelled as having a strict radical tear down in residual value show a negative development of their residual build-up and due to a change in perspective show a further decrease of the development in their residual build-up.

Based on the spectrum of stability and change (Figure 7.22) that covers radical build-up, different levels of stability and radical tear down, radical innovation is defined by using the four cells at each of the extremes of this spectrum. Following this definition 22 companies (26%) changed their perspective in twelve years. Using the proposed model it is possible to determine whether radical innovation occurred in each company and to determine the typology of radical innovation or the typology of stability of high order. Based on the analysis it can be concluded that radical innovation is rare and that the perspective of most companies is stable.

Due to organisational inertia, radical innovation is expected to occur more frequently in smaller companies than in multinational or multidivisional companies. Organisational inertia is based on the heterogeneity of institutionalisation, the diversity of the company's activities and the heterogeneity of the core stakeholders. Following Schumpeter it is expected that radical innovation will occur more frequently in relatively new industries and that fewer radical innovations will occur in mature industries.

In this analysis physical production was defined as mature and services as relatively young. The findings of this analysis are presented in Figure 7.61. It may be concluded that radical innovation indeed occurs more frequently in relatively young industries. The hypothesis about radical innovation and size can be neither confirmed nor rejected since smaller companies indeed achieved most of the radical innovations, but AEX companies also achieved more radical innovations than Midcap companies.

		Radical innovation		Strict definition	
-Size	-AEX	4	(24%)	0	(0%)
	-Midcap	1	(8%)	0	(0%)
	-Smallcap	17	(31%)	4	(7%)
	-Total	22		4	
Industry	-Physical production	7	(18%)	0	(0%)
	-Distribution and communication	7	(28%)	2	(8%)
	-Services	8	(38%)	2	(10%)
	-Total	22		4	

Figure 7.61: Radical innovation related to size and industry

7.7.3 Combining incremental and radical innovation

The traditional punctuated equilibrium paradigm uses coupled variables to detect incremental and radical change. All changes that cannot be defined as radical are defined as incremental changes. The proposed model de-couples the variables in order to detect incremental and radical innovation. This means that incremental innovation and radical innovation are analysed independently and that the expectations about the frequency of the two types of innovation becomes less obvious. Through linear extrapolation the periodicity of both stability in exploration and exploitation (defined as the period in which half the population changed their perspective or incremental innovation occurred) can be calculated. This analysis is based on the initial data set of 85 companies which were analysed with an average of 12.73 years (Figure 7.1). The periodicity of exploitation is 11 years (58% change in 12.73 years) to 24 years (26% change in 12.73 years) in exploration.

The exploitation – exploration dilemma means that incremental and radical innovation are intertwined. In Chapter six it was shown that there is a tension between maximising operational cash flow and maximising the build-up of residual value. It is also assumed that radical innovation and hence a change of perspective create new opportunities to gain long term dominance and as a result, will also positively influence the company's ability to increase the development of its operational cash flow. Besides a distinction between companies with a positive and negative radical innovation, a second distinction is made between the period before and after the 'break' or radical innovation. A calculation of the average annual growth of the operational cash flow is calculated before and after the break. The impact of radical innovation on the development of operational cash flow provides evidence (Figure 7.62) that radical innovation has a significant influence on the development of OCF; positive radical innovation accelerates the development of the operational cash flow and a negative radical innovation decreases the development or even diminishes the operational cash flow.

Radical innovation and operational cash flow				
	Delta OCF per year			
	Average	Before radical innovation	After radical innovation	Significance
-Radical innovation	0.505			
-Build-up (Beta>0)	0.593	0.438	0.943	p = 0.034**
-Tear down (Beta<0)	0.260	0.491	-0.397	p = 0.012**
-Stable build-up	0.815			
-Total	0.735			

** Significance at 95% level

Figure 7.62: Radical innovation and its impact on operational cash flow

A summary of the empirical results, in relation to the research questions presented in the first Chapter and the hypotheses in Chapter five, is presented in Figure 7.63 and Figure 7.64. Given the empirical results and results of the validation analyses none of the hypotheses are rejected (Figure 7.65). Based on Figure 1.4, it can be concluded that most (53%) of the companies changed from their focus on exploitation but remained stable (74%) in exploration (Figure 7.64).

Research questions (Chapter 1) / Hypotheses (Chapter 5)	Does stable exploitation lead to higher levels of exploitation?	Is exploration more stable than exploitation?	Does a change of exploration, or radical innovation, has an impact on the level of exploitation?
Hypothesis 1: In exploitation successful companies are consistent in the selection and deployment of a generic strategy.	Stable focus creates higher levels of OCF (12%) than incremental innovation		
Hypothesis 2: Companies that follow an added value strategy will be more successful in exploitation than companies that follow an efficiency or volume strategy.	Added value strategy generates higher levels of OCF than efficiency (58%) or a volume strategy (27%)		
Hypothesis 3: An added value strategy will lead to adverse developments in efficiency and vice versa. This is generally known as the Porter-dilemma.	Added value strategy has an inverse relation with efficiency and vice versa		
Hypothesis 7: Incremental innovation occurs at least twice as often as radical innovation.		Periodicity of a stable perspective is twice (2.2) as long as the periodicity of the deployment of a generic strategy	

Figure 7.63: Emperical findings in relation to research questions and hypotheses (part 1)

Research questions (Chapter 1) / Hypotheses (Chapter 5)	Does stable exploitation lead to higher levels of exploitation?	Is exploration more stable than exploitation?	Does a change of exploration, or radical innovation, have an impact on the level of exploitation?
Hypothesis 5: Radical innovation occurs more frequently in the service industries than in the physical production industries		Companies within relative young industries are more sensitive to changes of perspective than companies in mature industries	
Hypothesis 6: Radical innovation occurs more frequently in small companies than in multinational or multidivisional companies.		Smaller companies are more sensitive to changes of perspective than medium-sized or large companies	
Hypothesis 4: Radical innovation is a rare phenomenon and implies that in most companies the build-up of total resource productivity is stable.		Most companies (74%) do not change their perspective within the analysed period of 12.73 years	
Hypothesis 8: Radical innovation increases the development of operational cash flow when this radical innovation is the result of a build-up residual value and a tear-down in residual value when the radical innovation results in a reduction in the development of operational cash flow.			Radical innovation and hence exploration influences the development of operational cash flow and thus exploitation (Figure 7.62)

Figure 7.63: Emperical findings in relation to research questions and hypotheses (part 2)

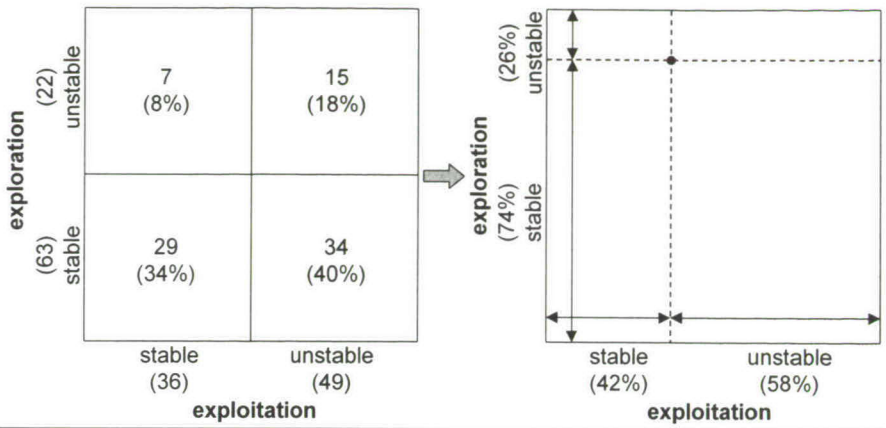
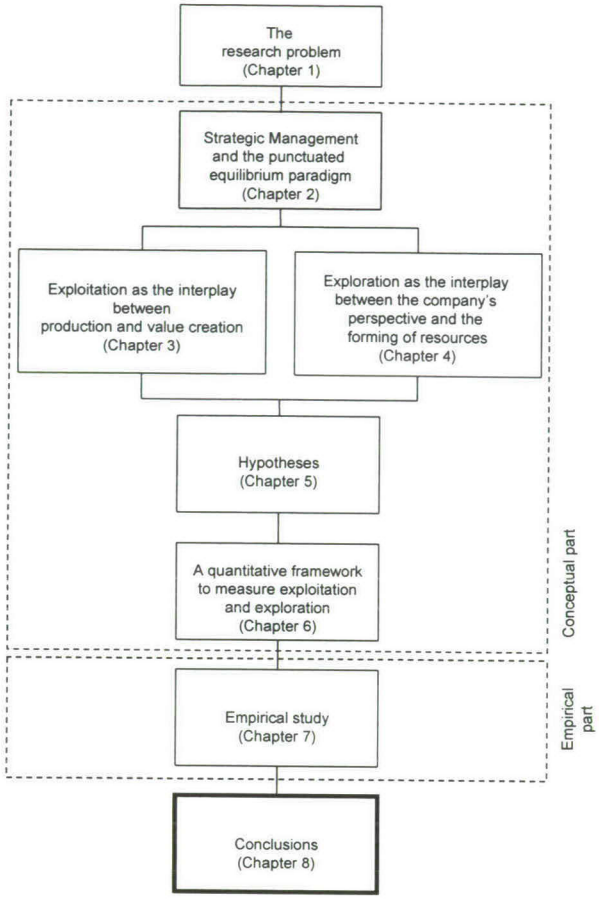
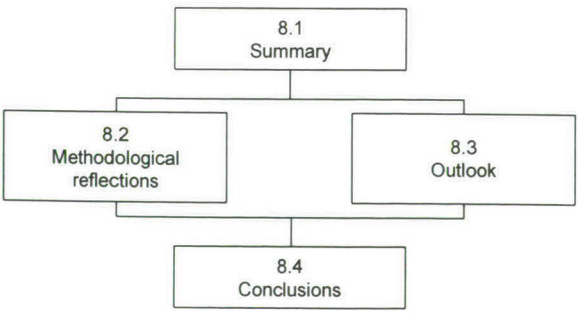


Figure 7.64: Results of stability and change for 85 companies

Subject	Hypothesis	Status
Incremental innovation	1	confirmed
	2	confirmed
	3	confirmed
Radical innovation	4	confirmed
	5	confirmed
	6	not rejected
Incremental & radical Innovation	7	confirmed
	8	confirmed

Figure 7.65: Status of formulated hypotheses


The
research problem
(Chapter 1)
Strategic Management
and the punctuated
equilibrium paradigm
(Chapter 2)
Exploitation as the interplay
between
production and value creation
(Chapter 3)
Exploration as the interplay
between the company's
perspective and the
forming of resources
(Chapter 4)
Hypotheses
(Chapter 5)
A quantitative framework
to measure exploitation
and exploration
(Chapter 6)
Conceptual part
Empirical study
(Chapter 7)
Empirical part
Conclusions
(Chapter 8)


8.1
Summary
8.2
Methodological
reflections
8.3
Outlook
8.4
Conclusions

8. Conclusions

In this Chapter a summary (section 8.1) and several methodological reflections will be provided (section 8.2). In section 8.3 the possible impact and an outlook on the usability of the framework will be discussed.

8.1 Summary

8.1.1 Scope of this study

This study focuses on the exploitation – exploration dilemma and uses the punctuated equilibrium paradigm to detect incremental innovation as a determinant of exploitation, and radical innovation as a determinant of exploration. The exploitation – exploration dilemma has obtained a profound place in management sciences. It addresses the question of whether and how a company balances operational value creation and the development of resources. The continuous search to find a balance between exploitation, with its focus on maximising operational value creation, and exploration, with its focus on maximising the development of resources, is part of the strategy process.

Within a company five processes and a process hierarchy as well as four core stakeholders are defined. By stressing the dynamics of a company and using processes to describe the dynamics of the behaviour of a company, the entity of a company is defined as the unit of analysis. The dynamic resource perspective stresses aspects of learning, the perspective of the company as the high order of a company, and the development of resources and therefore encompasses the punctuated equilibrium paradigm. With the company as the unit of analysis, the different processes within the company and the processes between the company and its environment, and the interplay between these processes are not distinguished. By defining the company as the unit of analysis its intentional and unintentional behaviour can be analysed.

The process of operational value creation is related to the process of production and can be analysed by using value chain analysis and the deployment of generic strategies.

In Chapter three it was argued that a stable deployment of a single generic strategy is worthwhile and that a change in the deployment of a generic strategy implies a change of focus on the process of production which is defined as incremental innovation. In Chapter six operational cash flow (OCF) was chosen to determine if a single generic strategy dominates the development of the value creation process or that, due to changes in the focus on the process of production, incremental innovation dominates the aspect of exploitation.

The process of forming resources was related to endogenous growth theory and was defined as growth that cannot be related to one of the core stakeholders of the company. This is also known as the total resource productivity (TRP) or residual value. In Chapter four it was argued that, due to a coherent and stable relation between the company and its core stakeholders, the deployment of a specific perspective implies a stable build-up of residual value. It was also argued that a change of perspective leads to changes in the combination of the existent core stakeholders or to different core stakeholders and thus to a shift in the development of the residual value. Radical innovation was defined as a deployment of a new perspective, vision or mission of the company.

The relation between exploitation and exploration can, besides using the punctuated equilibrium paradigm and the dynamic resource perspective, also be analysed using of the contractual theory of the firm (Chapter two, section 4). The contractual theory of the firm includes non-contractual elements, such as loyalty and trust. It was argued that during radical innovation the market structure can be used as the most efficient instrument to select and attract core stakeholders. Similarly, within the company's perspective bilateral governance structures between the company and the different core stakeholders are essential to optimise the production process and the value creation process. Through the use of bilateral governance, these contracts result in a minimisation of opportunism.

Given the scope of the exploitation – exploration dilemma, companies have to balance exploitation and exploration and hence the framework intended to detect incremental and radical innovation should not exclude one or the other but must allow for both types of innovations at the same time.

For this purpose the punctuated equilibrium paradigm was modified. By using generic firm processes and the stakeholder approach the punctuated equilibrium paradigm can be placed the field of strategic management. Generic firm processes were chosen since, without following a specific strategy framework, they include processes such as defining ambition, forming resources, production and the process of value creation. The stakeholder approach was chosen since it provides an insight into the economics of scarcity and the delicate boundaries of a firm; only when a stakeholder and the company define the relationship as existing, are interaction and development relevant. Employees, customers, partners and shareholders are the core stakeholders of the company. As a result, the stakeholder approach provides an insight into the interactions of the company with its environment and generic firm processes provide an insight into the focus and orientation from which perspective the company defines its current relationships. Following the analysis presented in Chapters two, three and four a modification of the punctuated equilibrium paradigm is accepted to analyse the exploitation – exploration dilemma (***First Research Question***). In Figure 8.1 a schematic outline of the study is presented.

By combining generic firm processes and the stakeholder approach a framework was generated in which the orientation and the content of the different interactions between a company and its core stakeholders can be analysed (Figure 6.13). Following the contractual theory of the firm and the dynamic resource perspective, the process of preference formation and learning and hence innovation requires interaction between the different core stakeholders and the firm and leads to path dependency and the development of an identity through these interactions.

Based on this study it can be concluded that an analysis of the exploitation – exploration dilemma, based on generic firm processes, is possible. In this study exploration was related to the process of forming resources and exploitation towards the process of production. Besides drawing conclusions about stability or innovation in both exploitation and exploration, the type and direction of developments could also be made visible. In this study a change in the scope of the orientation of the process of production was defined as incremental innovation.

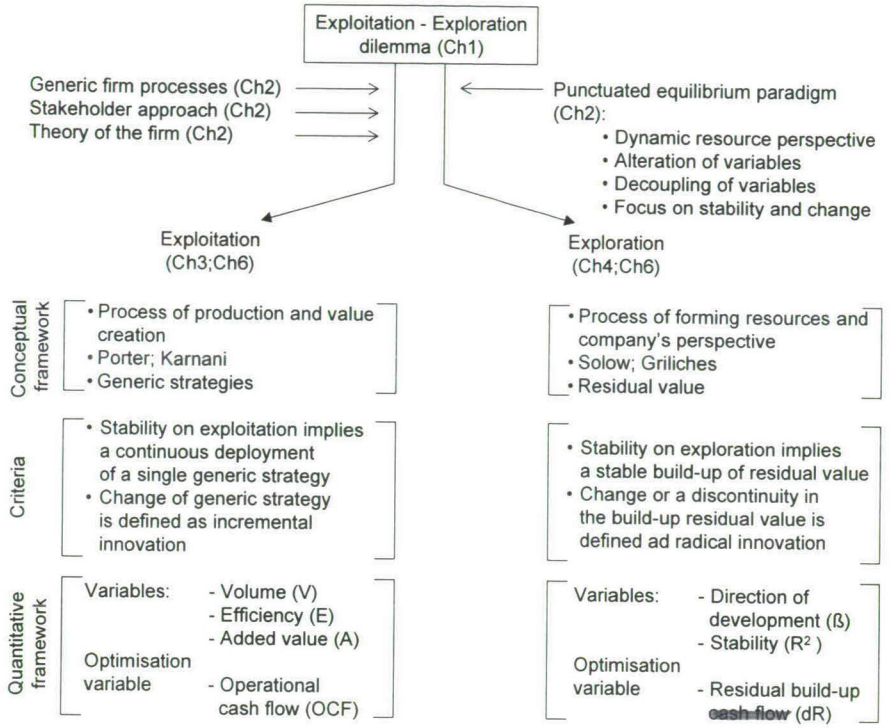


Figure 8.1: Summary

A change in the development of the process of forming resources was defined as radical innovation. From this perspective, incremental and radical innovation were not defined as two extremes on one dimension but as developments on two dimensions related to different generic processes within a single company. Due to the interdependence of the defined generic firm processes exploitation and exploration are decoupled but remain intertwined (Figure 8.2).

8.1.2 Exploitation

Optimising the process of production has to do with aligning or 'fitting the organisation' and was achieved within the boundaries of the company's perspective. The concept of the value chain and value chain analysis provides a useful framework to detect stability on the focus on the production process or a change in the focus of the production process or incremental innovation.

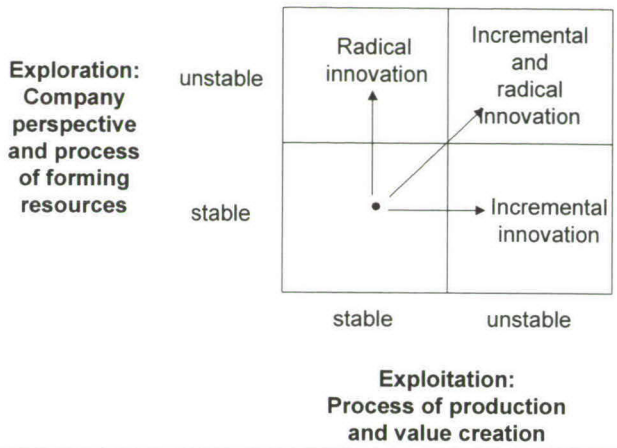


Figure 8.2: Innovation related to exploitation and exploration

Based on the work of Porter (Porter, 1980; 1985) and Karnani (Karnani, 1984) three generic strategies were defined; volume, efficiency and added-value. A quantitative framework was developed in order to analyse the development of operational cash flow for these three generic strategies. Programmes such as JIT, BPR and TQM may lead to a change in the organisation of the company's value chain and thus induce a change in generic strategy or incremental innovation and may also strengthen the focus of a company, and thus strengthen the impact of the deployed generic strategy.

8.1.3 Exploration

The exploration of new possibilities requires a different approach. From the company's perspective, a company concentrates on combining and recombining resources in such a way that the existing core stakeholders benefit and new resources are developed and deployed. Within the company's perspective no fundamental changes occur in the firm's basic orientation towards its customers, employees, partners and shareholders and hence the build-up of resources or residual value, which cannot be related to one of the core stakeholders, is expected to be stable. As a result of radical innovation or a change of high order, resources and the related core stakeholders are viewed from a different perspective, which leads to a situation where different and new positional advantages and different competencies are developed and hence the build-up of residual value alters.

From an economic perspective, residual value can be related to theories on endogenous growth. The initial economic models developed by Solow and Abramowitz concluded that the two production factors, capital and labour, only explain a small proportion of economic growth. The missing element was defined as residual value. Current studies indicate that there has been little progress in narrowing the conceptual size of residual value. In economic theory a change in the build-up of residual value is a determinant of change of perspective or paradigm. By applying the Solow-model to companies, the residual value, or total resource productivity, is defined as knowledge or intellectual capital and cannot be related to anyone of the core stakeholders of the company. In this framework, knowledge or intellectual capital is the result of the process of combining and recombining resources, which can be related to aspects of learning.

Radical innovation occurs when the direction of the residual build-up in a given period differs from the overall development and is contrary to the development in the previous period. Under this framework two types of radical innovation can be identified:

- Companies with a strict radical build-up show a low correlation between the residual build-up and the linear regression line of the residual build-up, an overall positive development of the linear regression line and a break away from the linear regression line towards a more positive development. Under this definition companies labelled as having a 'strict radical build-up' show a positive development in their residual build-up and, due to a change of perspective, even increase the development of their residual build-up.

- Companies with a strict radical tear down show a low correlation between the residual build-up and the linear regression line of the residual build-up, an overall negative development of the linear regression line and a break away from the linear regression line towards a more negative development. Under this definition companies labelled as having a 'strict radical tear down' show a negative development of their residual build-up and, due to a change of perspective, show a further decrease in the development of their residual build-up.

8.1.4 Interaction between incremental and radical innovation

This study is about the behaviour of companies in relation to exploitation and exploration and does not focus on the intention or reasons for consistency or change but only on behaviour itself. Contrary to the punctuated equilibrium paradigm, exploitation and exploration were not defined within a single dimension, but as partially dependent dimensions each with its own continuum:

- Exploitation and exploration are partially dependent on each other because incremental innovations may occur within the company's perspective and radical innovations may occur without changing the generic strategy of operational value creation.
- Exploitation and exploration are partially dependent on each other while incremental innovations can be induced by radical innovation and radical innovation can be induced through incremental innovations.
- The optimising variable for exploitation is the development of operational cash flow and the continuum of exploitation is related to the defined generic strategies instead of a change in the deployment of a single generic strategy or incremental innovation.
- The optimising variable for exploration is the development of additional resources such as assets, positional advantage and competencies. The continuum of exploration is related to the stability of the build-up of these resources or high order versus a change in the build-up of resources or radical innovation.

Both types of innovation are intertwined and the success of both types of innovation are related to the effectiveness of their interaction, the chosen unit of analysis was not the effectiveness of the different processes related to incremental or radical innovation but related to the company as a whole.

8.1.5 Empirical results

An empirical test was carried out to validate the proposed framework and used data from 85 companies listed on the Amsterdam Stock Exchange. Due to the

defined boundaries and limitations, presented in Chapter six, the data sample was limited; since longitudinal analysis is essential to detect stability, incremental and radical innovation, the selected companies should have traded publicly for at least ten years or more. The behaviour of 85 companies, which covers 60% of the active population, listed on the Amsterdam Stock Exchange between 1988-1997, was analysed to determine stability in exploitation and exploration or incremental or radical innovation.

Results related to exploitation	
- Incremental innovation	49 (58%)
- Stable focus	36 (42%)
- Volume	13 (15%)
- Efficiency	6 (7%)
- Added value	17 (19%)
- Total	85 (99%)

Figure 8.3: Results related to exploitation

Based on the findings, 58% (49 out of 85 companies) changed their focus on the process of production and value creation. The rest of the analysed companies, 36 companies (42%), deployed a single generic strategy in such a way that most of the development of the operational cash flow (OCF) over the analysed period can be traced to the development of that generic strategy (Figure 8.3). The development of the OCF was analysed per generic strategy and for incremental innovation. Based on these findings it can be concluded that a deployment of a generic strategy in general pays off (+11% in comparison to incremental innovation) (***Second Research Question***), however the development of OCF differs per generic strategy (added value 29%; efficiency –18%; volume +2% in comparison to incremental innovation). The empirical study not only found that an added value strategy realised higher developments of OCF than an efficiency strategy (+58%) or a volume strategy (27%) but also confirmed the existence of the Porter dilemma: companies that deployed an added-value strategy have a negative OCF impact on the level of their efficiency and vice versa. Radical innovation was found to be rare, only 22 out of 85 companies (26%) changed their high order (Figure 8.4).

Results related to exploration		
- Radical innovation	22	26 (58%)
- Strict definition	4 (5%)	
- Stable	63	(74%)
- Total	85 (100%)	

Figure 8.4: Results related to exploration

Most companies (74%) show a stable build-up in their residual value and thus are stable in the deployment of their perspective. The frequency of incremental innovation is almost twice as high as the observed frequency of radical innovation. A change in perspective does not automatically imply a positive shift or additional build-up of resources. Two companies were found with a radical tear down of their residual value. Due to endogenous or exogenous developments, these companies were unable to successfully deploy a new perspective or even successfully maintain their current perspective. A change in perspective not only implies a shift in the development of resources but also in the development of the operational cash flow of these companies. The expectation that organisational inertia blocks radical innovation was not rejected. The expectation that radical innovation occurs more frequently in relatively new industries was confirmed. Based on the findings presented in Chapter seven exploration is more stable than exploitation (***Third Research Question***).

According to the exploitation – exploration dilemma, incremental and radical innovation are intertwined. The punctuated equilibrium paradigm uses coupled variables to detect incremental and radical innovation and hence all changes that cannot be defined as radical are defined as incremental changes. The proposed model de-couples the variables to detect incremental and radical innovation. This means that incremental innovation and radical innovation can be analysed independently and the expectations related to the frequency of incremental and radical innovation are less obvious.

In Chapter six it was shown that a tension occurs between maximising operational cash flow and maximising the build-up in residual value. It was also assumed that radical innovation and hence a change in perspective creates new opportunities to gain long-term dominance and as a result will positively influence the company's ability to increase the development of its operational cash flow. Besides an analysis of stability and radical innovation, an analysis was made to which analyse the development of OCF of companies with positive and negative radical innovation before and after radical innovation. By calculating the average annual growth before and after the change in perspective, the impact of radical innovation on the development of operational cash flow was detected (Figure 8.5). By splitting residual build-up and residual tear down it was concluded that radical innovation has a distinct impact on the development of the operational cash flow. Positive radical innovation accelerates the development of operational cash flow, and negative radical innovation decreases the development or even diminishes the operational cash flow (***Fourth Research Question***).

8.2 Methodological reflections

In Chapter six the boundaries of the framework were presented. Besides these boundaries several additional remarks on the chosen methodology can be made. These remarks are related to the framework for incremental innovation (8.2.1), the framework for radical innovation (8.2.2) and the empirical study (8.2.3).

Radical innovation and operational cash flow				
	Delta OCF per year			
	Average	Before radical innovation	After radical innovation	Significance
-Radical innovation	0.505			
-Build-up (Beta>0)	0.593	0.438	0.943	p = 0.034**
-Tear down (Beta<0)	0.260	0.491	-0.397	p = 0.012**
-Stable build-up	0.815			
-Total	0.735			

Figure 8.5: Radical innovation and impact on operational cash flow

This study does not focus on the normative nature of innovation; therefore it cannot be concluded that companies will thrive by achieving incremental or

radical innovation. Nor can it be concluded that radical innovation is of greater importance than incremental innovation. This study focused on defining and detecting incremental and radical innovation. The most logical next step would be 'developing and delivering' or the definition of 'which company should do what'. These issues, which are company and moment specific, are very relevant. The developed framework to detect exploitation and exploration, can be helpful in providing answers, but these aspects are not part of this study.

The fundamental unit of analysis is a single company and how it company interacts with its environment. This level of aggregation could also be adjusted to different levels, such as subsidiaries or divisions. The frequency of analysis could also be altered. By using data available in management information systems the frequency of analysis could be altered from an annual measurement to a quarterly or monthly analysis. The balance between exploitation and exploration could probably also be analysed through the aggregation (Zegveld, 1994) or disaggregation of companies. The definition of a company focuses not only on generic firm processes and the orientation of the core stakeholders to understand the direction of the development of the company, but also on the scarcity of the different core stakeholders. Following the contractual theory of the firm, a market can be described where both the company and the core stakeholders can decide to join, to stay or to leave. This company model does not have to imply a shift away from 'customer-oriented' or 'shareholder value oriented' firms but merely states that these views are the result of company-specific and core stakeholder-specific trade-offs. It could be reasoned that due to an increase in the scarcity, these trade-offs are increasingly unstable and hence should be differentiated per company to subgroups of the defined core stakeholders. A focus on 'customer-orientation' or 'shareholder value' should not be rejected, however defining these types of focus as 'company ideologies' should be rejected.

8.2.1 Reflections on the framework for exploitation

The use of generic strategies is frequently discussed and in Chapter six several of these studies were summarised. In most cases generic strategies focus on the product level of firms. This analysis focused on the firm level and thus differs from these studies. The interpretation of incremental innovation is bounded by the use of value chain analysis and the definitions of 'volume', 'efficiency' and

'added-value'. The difference in aggregation might also imply that on a product level different generic strategies can be detected when comparing these with the findings at a company level. As stated earlier the developed framework does not consider the intentions of the behaviour of companies but only analyses the results of behaviour.

8.2.2 Reflections on the framework for exploration

The contractual theory of the firm and its focus on the relationship between the objectives of the core stakeholders and the objectives of the firm uses a dynamic resource perspective to understand the process of exploration. Of the four defined core stakeholders only two core stakeholders (employees and shareholders) form the essence of the analysis of radical innovation. However, although the parameter 'output' is directly related to the buying behaviour of customers, customers as such are not part of the core of the analysis. Customers and partners however, can be included when parameters can be defined related to their behaviour and influence on the firm, and data related to these parameters is available. This is not yet the case. Besides the four core stakeholders, stakeholders in general can also be included in the analysis. By including more stakeholders, such as the environment or energy, even more parameters and data are required.

Residual value is less concrete than OCF. Within economics residual value is related to the creation of knowledge. The new growth theory (NGT) (Nelson, 1999) in particular places knowledge in the centre of economic growth and prosperity. On a national level the perspective or paradigm changes when a major shift in the development of residual value can be measured. The recent discussion on the existence of the "new economy" is primarily induced by the sharp raise of the residual value in the USA. The developed framework provides the possibility to analyse all companies on the development of residual value. An analysis on both America-Online (AOL: 'radical build-up') and Time Warner (TWX: 'stable continuous build-up') may provide an additional explanation why many analysts value AOL higher than TWX. The complexity of the 'new economy' can be illustrated by the fact that the Dutch internet provider World-online (WOL) was classified as 'radical tear down'.

8.2.3 Reflections on the empirical study

The data set may have had several shortcomings. Longitudinal analysis and the choice of 1988-1997 implies that only companies that were active in this period were selected; this excluded start-ups as well as companies that terminated their activities in this period. A second shortcoming may lie in the fact that the selected companies are listed on the Amsterdam Stock exchange, which may introduce a bias based on size, governance structure or other factors. The choice of 85 companies, which is a relatively small number, may also have had an impact on the research findings. It is impossible to estimate these biases or how to correct them. The selected companies represented 60% of the number of companies of the total population and 93% of the market value of the total population.

Besides the data set the use of a minimum of ten years of data is also arbitrary. From the finding that 58% of the population achieved an incremental innovation and that 26% changed achieved radical innovation, it can at least be concluded that the ten-year period chosen was not too small to detect innovations. The validation, presented in Chapter seven, based on an analysis on the defined hurdles, a qualitative analysis and the use of a different data set, was limited and although it did not prove the correctness of the developed framework, it did not find any argument to alter the framework and thus the developed framework was accepted.

8.3 Outlook: beyond defining and detecting incremental and radical innovation

The definition and detection of exploitation, exploration and incremental and radical innovation, as determinants of exploitation and exploration, formed the subject of this study. Following the definitions provided, not the programmes, actions or intentions, but the actual results were analysed. Exploitation was related to the development of operational cash flow and was linked to the process of production and value creation. Exploration was related to a shift in the development of residual value or intellectual capital as a result of a change in perspective.

Schumpeter (Schumpeter, 1934) found that innovations are induced not only by developments in technology but can also be related to developing new sources of materials, new markets and new forms of organisation. Scholars from the technical and social sciences have also studied innovation and the process of innovation. Several studies have also been made of what is known about innovation (Rothwell and Zegveld, 1981) but not much has been integrated (Pennings and Buitendam, 1987). Several studies of innovation found that implementing innovation is one of the least understood aspects in the innovation process (Pisano, 1994; van de Ven 1993). Studies by historians (Gille, 1978) and studies about the diffusion of innovation (Gold, 1981) have identified the importance of the "*system of innovation*" and the "*networks of interdependent elements*". Aspects such as "*path dependencies*" (Arthur, 1988; David, 1985) and "*lock-out*" (Dosi and Orsinego, 1988) have also been found to be essential in understanding the essence of innovation. Nelson and Winter (Nelson and Winter, 1982) found three determinants that lead to innovation: the market structure of demand, the nature and strength of opportunities, and the ability of firms to appropriate the returns from their investments.

Most innovation studies focus on products, industries or nations. The use of a firm as the fundamental unit of analysis is rare. Innovation studies that focus on the role of the firm as a whole (Burgelman, 1994; Eisenhardt and Schoonhoven, 1990; Hamel and Prahalad, 1994; Utterback, 1994) focus on the stages or phases of innovation or on aspects that induce these innovations. Only a few studies have focused on the distinction between incremental and radical innovation and defined the company as the fundamental unit of analysis (Gersick, 1994; Nadler and Tushman, 1997; Tushman and O'Reilly III, 1996; Tushman et al, 1997; Tushman and Romanelli, 1985). Besides incremental and radical innovation different types of innovation can also be recognised (Henderson and Clark, 1991), however no coherent framework was found that provides an integrated approach. Following the contractual theory of the firm, the framework focuses on relational competencies between the firm and its core stakeholders.

In Chapters two to four the means to detect exploitation and exploration, through the use of generic firm processes and the scarcity of the core stakeholders, were linked to incremental and radical innovation. In the Western

Hemisphere in particular it is expected that, no one of the core stakeholders continually dominates the ranking of scarcity. To remain competitive, companies, especially those in the Western Hemisphere, need to compete on heterogeneity, added value and thus cannot rely on copying, but must make changes or innovations themselves. From this perspective the process of forming resources is crucial and means that product and resource-heterogeneity will become the basis for competition. By combining the dynamic level of scarcity of the different core stakeholders, the ambidextrous nature of companies and the need to make changes or innovations stresses the continuous effort to exploit and explore. As a result innovation can best be characterised as a process. The process orientation of innovation stresses the continuous effort to exploit and explore by combining and recombining resources, existing and new core stakeholders and activities within the value chain.

The process orientation of strategy and innovation is, recognised by many authors from a variety of different backgrounds (van Asseldonk, 1997; 1998; Goldman et al, 1995; Goranson, 1997; Hammer and Stanton, 1999; Preiss, 1997; Zegveld, 1998; Zegveld and den Hartigh (eds.), 1998). Van Asseldonk (van Asseldonk, 1997; 1998) and Goldman (Goldman et al, 1995) both link innovation to the different activities of the firm and state that besides the development of new activities, the combination and recombination of activities is also essential to achieve innovation. Implicitly both authors describe a system of innovation on a company level. At a different level of aggregation Gille and Gold (Gille, 1978; Gold, 1981) concluded that there is a system of innovation and a system of networks of interdependent elements (Freeman, 1991). These networks can be related to the existence of routines and elements of path dependency. In this study the elements, institutions or agents were defined as the core stakeholders and can be differentiated according to different groups of core stakeholders. The interactions between the core stakeholders and a company have several similarities with network theory (Fombrun, 1982) or with the concept of organisational order (Nonaka, 1988; Romer, 1995). Both network theory and organisational order focus on the behaviour of the core stakeholders as entities or agents. Each of the core stakeholders has different objectives, has a different impact on the development of the resources, and has a different level of scarcity.

Only through interaction and exchange can the objectives of the core stakeholders be realised and organisational order, also based on the use of bilateral governance structures, be established. Through bilateral governance structures the objectives of the firm and the objectives of the core stakeholders can be realised and opportunistic behaviour by the core stakeholders and the firm can be minimised. Through these interactions, paths and routines as exponents of organisational order emerge and the processes of probing and learning can take place (Barnett and Hansen, 1996; Bruderer and Singh, 1996; Lynn et al, 1996). The existence of core stakeholders and their processes of interaction can also be approached from a neo-institutional perspective (Hodgson, 1988; 1998). Under this perspective the company provides an institutional framework which minimises opportunism and where utility maximisation per core stakeholder and by the company is balanced through the use of routines.

The institutional perspective of innovation has been developed and promoted by several authors such as Nelson, Rosenberg, Freeman, Soete, Teece and Pavitt (Dosi et al, 1988; Nelson (ed.), 1993) and is called the "*national system of innovation*" (NSI). However, although their level of aggregation is a nation, the concept probably also applies to companies; it focuses on innovation and how the different agents and institutions within the system interact. Nelson (Nelson (ed.), 1993) stated that the institutional concept is relevant in detecting change or innovation as well as its impact on the system itself and how the system evolves as a result of these changes. Too strict a focus on innovation itself is too narrow to understand the actual interplay between innovation and the development of the system itself. The existence of incremental and radical innovation is also recognised by Nelson (Nelson (ed.), 1993; Nelson, 1991) and integrated in his concept of NSI. A first attempt to disaggregate NSI was undertaken by Davenport and Bibby (Davenport and Bibby, 1999) and Porter (Porter, 1990) but a coherent 'company system of innovation' (CSI) is not yet available. Under the concept of NSI a relationship is suggested between the institutional parties, their processes of exchange and interactions and the types of innovation defined. Company-specific analysis should provide specific information about stability and incremental or radical innovation. As a result the framework developed can be used as a management tool.

Based on this study the ongoing process of exploitation and exploration is intended to maximise both operational value creation and the process of forming resources. Activities can be related to the value chain and to the core stakeholders or differentiated core stakeholders of a company. This stresses the process orientation of innovation (Figure 8.6).

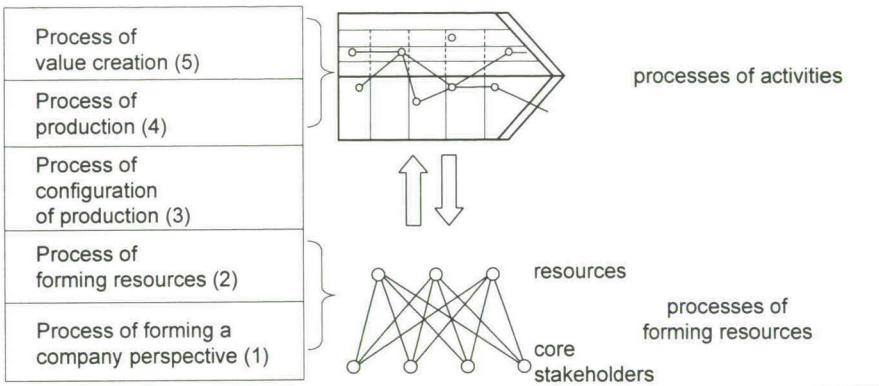


Figure 8.6: The process orientation of a company

The process orientation of the exploitation – exploration dilemma and the disaggregation into core stakeholders, resources and activities stresses aspects of learning and the possibility of learning. Assuming that OCF and residual value are levels of fitness, then the process of recombining existing core stakeholders and combining with new core stakeholders, resources and activities, leads to a different level of fitness in both exploitation and exploration. Theoretically a fitness landscape for both exploitation and exploration can be drawn in which all theoretical combinations and their fitness are provided (Figure 8.7). This theoretical map provides detailed information about which combinations of core stakeholders, resources and activities generate the highest level of fitness.

Due to the fact that theoretical combinations cannot be measured and the fact that combinations probably do not form a linear fitness function (Kauffman, 1993; Warglien, 1995a; 1995b), exploitation and exploration might be interpreted as stochastic processes.

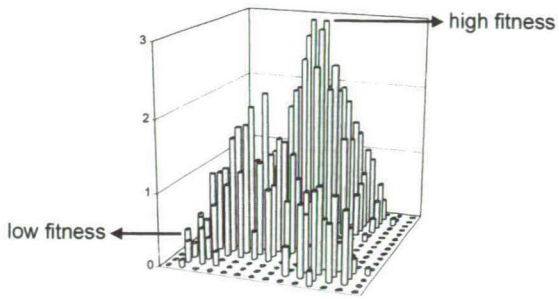


Figure 8.7: Fitness landscape based on theoretical combinations

No linear expression is expected between a single activity and the fitness of a company, probing and learning (Levinthal and March, 1993; Lynn et al, 1996), or learning by doing (Arrow, 1962; Holland et al, 1987) are essential to achieve higher levels of fitness in both exploitation and exploration. Dosi, Teece and Winter (Dosi et al, 1992) found that coherence while forming new combinations is essential. This implies that the company's perspective is essential and limits infinite experimenting (Deephouse, 1999), which follows the findings of Levinthal (Levinthal, 1994) that successful firms are often difficult to imitate effectively because this not only requires an imitation of products but also an imitation of its activities and routines.

Kauffman (Kauffman, 1993) and McKelvey (McKelvey, 1999) developed specific strategies for combining agents, defined here as activities, core stakeholders and resources, to achieve a higher fitness which means that the expensive and risky strategy of random paths becomes obsolete. These strategies are related to the number of interactions (K) between the number of different agents (N). When the number of interactions between the agents is small (K=1) no local optimum prevents finding the global optimum and every new combination with a higher fitness is a step in the right direction. Conversely when the number of interactions between the agents is large (K=N-1) local optima occur which may result in optimising local optima instead of searching for the global optimum.

Parallel searching (Figure 8.8) provides multiple information on the fitness landscape (Beinhocker, 1999; Kauffman, 1993; Levinthal, 1997; Levinthal and Warglien, 1997; McKelvey, 1999). This strategy is only useful when the framework to measure exploitation and exploration can be dis-aggregated to specific combinations of activities such as divisions, products or even single customers. From this perspective high fitness chains form the order or routine of a company and cannot be related just to the development of operational cash flow but also the build-up in residual value or intellectual knowledge. From the fitness point of view per process per type of innovation, new processes can be initiated and processes with a low fitness can be altered.

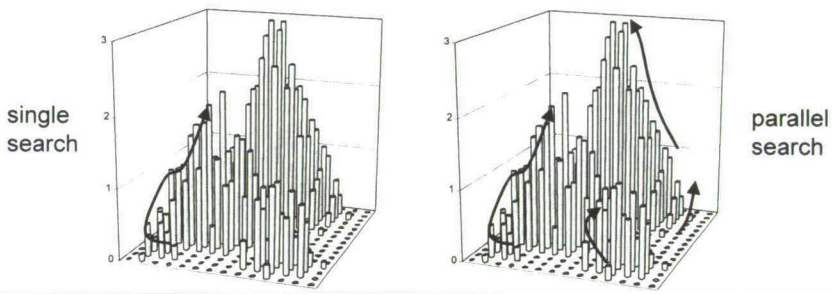


Figure 8.8: Parallel search in a fitness landscape

The development of innovation described above is not just theoretical. Following an institutional framework for innovation maximising the operational value and maximising the development of resources, and thus the perspective of the company, is essential. By using dual innovation strategies simultaneously, companies can resolve their exploitation – exploration dilemma. The development of a dual-focus on both exploitation and exploration and a disaggregation into different combinations of core stakeholders, resources, and activities parallel searching is possible without multiplying all optimising combinations. Besides the cost-effectiveness of this type of organisation, parallel searching becomes possible, which increases the only lasting competitive advantage of companies, namely the ability to learn (de Geus, 1997).

Parallel searching is only possible when there is a tool available to measure both exploitation and exploration. The framework developed here might serve as a helpful tool.

8.4 Conclusions

The developed framework measures developments in exploitation and exploration or developments in the orientation of the company's value chain and shifts in the process of forming resources, and may be a useful tool to analyse the exploitation – exploration dilemma

Unlike to the punctuated equilibrium paradigm, the framework simultaneously measures company-specific developments aimed at the focus and change of focus in the process of maximisation of the operational value creation and the process of forming resources.

The framework combines generic strategies in relation to operational value creation and the company's vision or perspective, with endogenous growth theory. The use of the stakeholder approach and generic firm processes is used to operationalise the dynamic resource perspective which enables a firm to transform and leverage the input by the different core stakeholders. Relational competencies between the company and the different core stakeholders are emphasised through the use of the contractual theory of the firm

The tool developed here is an operationalisation of the exploitation – exploration dilemma, which is part of the strategy process, and states that a balance can be found between refinement and selection or maximising short term cash flow or search and variation, or maximising the development of resources. The exploitation – exploration dilemma occupies an important place in management science but is conceptual and no other tool of measurement is known. By measuring the operational value creation and the development of resources simultaneously, a cautious first step is made towards challenging "*the biggest challenge*" (Drucker, 1999), i.e. measuring the productivity of knowledge workers and intangible assets.

ANNEX

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Annex B: Strategic Management

The literature on strategic management provides a wide range of different views, perspectives and related assumptions. To provide an overview of the different schools the reference point framework (Kahneman and Tversky, 1979) is used. The reference point framework uses prospect theory as a basis to describe behaviour at firm level and uses reference points in evaluating choices and behaviour above or below a specific target or reference point. It is assumed that by explicitly formulating reference points, top management influences the strategic behaviour of their organisations (Fiegenbaum et al, 1996). These strategy frameworks use different definitions and models of the strategy process, which can be related to the difference in scientific backgrounds and the scope and assumptions related to these backgrounds. By aggregating several strategy frameworks, Fiegenbaum (Fiegenbaum et al, 1996) found three reference points, namely internal, external and time, which are defined as the fundamental dimensions of strategic management. Two original strategy frameworks, i.e. the industrial organisations school and the resource framework, use 'extern' and 'intern' respectively as their reference points. Most studies develop on the fundamentals and assumptions of these schools or question the assumptions or research findings related to these schools. This sometimes results in hilarious debates (Ansoff, 1991; Mintzberg, 1991; Goold, 1992), on 'who is right and who is wrong'. Strategy frameworks that use 'time' as a reference point stress the impact of adaptation or learning. These strategy frameworks, such as 'game theories' (Brandenburger and Nalebuff, 1995) and 'dynamic capabilities' (Teece et al, 1997), can be defined as dynamic versions of the industrial organisation and the resource school, respectively. Other strategy schools use 'time' as a reference point and frequently use metaphors such as 'evolution' and 'ecology' which are derived from biology (Hannan and Freeman, 1987; Nelson and Winter, 1982). Defining the content or dimensions of reference points is not included in the prospect theory and has to be synthesised. According to various authors (Fiegenbaum et al, 1996; Amit and Schoemaker, 1993) the classical problem is matching the expected conditions of the external environment with internal capabilities, which follows the three elements strategy described in section 2.1. Based on a comprehensive literature study, Fiegenbaum, Hart and Schendel (Fiegenbaum et al, 1996) found three alternative perspectives or reference points: internal, external and time-related

reference points. Each of the three perspectives is used to judge the behaviour of the firm. A different perspective or reference point also includes a different theoretical perspective and related background and assumptions. Based on Fiegenbaum, Hart and Schendel (Fiegenbaum et al, 1996), Teece, Pisano and Shuen (Teece et al, 1997) and Brown and Eisenhardt (Brown and Eisenhardt, 1998) a theoretical perspective, a fundamental description of the intellectual roots and a generic model of strategy per reference point are presented in Figure 1.

Strategic reference point	Theoretical perspective	Fundamental description	Intellectual roots	Generic model of strategy
Internal	• Motivation theory (Latham and Yukl 1975) • Resource-based theory (Wernerfelt, 1984) (Barney, 1991) (Prahalad and Hamel, 1990)	• Design work and set goals for performance (individuals, groups) • Build unique competencies (firm-wide capabilities)	• Penrose • Selznick • Christensen • Andrews	Core competence: resource-based strategic management
External	• Industrial economics (Porter, 1980) • Institutional theory (Meyer, Scott and Deal, 1983) • Resource dependence theory (Pfeffer and Salancik, 1978)	• Beat the competition (industry and key competitors) • Meet demands of society (stakeholders) • Minimize constraints on resource (suppliers, customers)	• Mason • Bain	Five forces: industry-based strategic management
Time	• Corporate identity (Dutton and Dukerich, 1991) • Strategic intent (Prahalad and Hamel, 1989)	• The past shapes what is possible (past traditions) • Strategic intent informs current decisions (mission, long term purpose)	• Schumpeter • Nelson • Winter • Cournet • Nash	Game theory Dynamic capabilities
	• Game theory (Brandenburger and Nalebuff, 1995) • Dynamic capabilities (Teece, et al 1997)	• Strategic interaction (competitive and collaborative moves) • Firm-specific trajectories (asset accumulation and inimitability)	• Shapiro • Dosi	

Figure 1: Generic strategy models based on reference point theory

The internal strategic reference point uses internal variables to define the success of a company. Companies set targets for strategic inputs such as cost reduction, quality improvements and new product development and evaluate their performance based on these goals. Strategic inputs can be defined around

value-added activities (Porter, 1985) which forms the firm's central axis or the driving force of managerial concern. Simultaneously, firms also define strategic outputs such as sales and profitability and hold managers responsible for performance against these targets (Fiegenbaum et al, 1996). As a result self-reflection becomes very important. The external strategic reference point uses external benchmarks, such as competitors (industrial organisation), suppliers and customers (resource dependence) or society in general (institutional theory). By using time as a reference point 'past' and 'future' can be recognised as critical dimensions (Fiegenbaum et al, 1996). Accumulating knowledge over time can be used as a source of competitive advantage (Fiol and Lyles, 1985; Levitt and March, 1988) and provides a reference point to spur continuous achievements (Fiegenbaum et al, 1996). By defining a vision and related strategic intent the future can also be detected as a reference point. Primarily based on these three reference points (internal, external and time), and the work of Teece, Pisano and Shuen (Teece et al, 1997), and Brown and Eisenhardt (Brown and Eisenhardt, 1998), Figure 2 provides an overview of several aspects of the four generic models of strategic management.

Further to this, two groups can be aggregated from the four generic models which results in eliminating 'time' as one of the reference points. Eliminating 'time' as a reference point can also be explained by the fact that Game Theory is a dynamic development of the industry-based strategic management model and dynamic capabilities is a dynamic development of the resource-based strategic management model (Figure 3).

Based on these findings, it can be concluded that the industry-based strategic management model and the resource-based strategic management model calibrate the means of strategic management. In the next two paragraphs the essential elements of these two original models will be provided.

B.1 Industry-based strategic management

The industrial organisation theories study specific markets, and consider a range of market structures from monopoly to oligopoly. Individual firms are

Aspects	Core competence	Five Forces	Game theory	Dynamic capabilities
Assumptions (a)	• Firm as a bundle of comptencies	• Stable industry structure	• Industry viewed as a dynamic oligopoly	• Firms operating in rapid technological change
Goals (b)	• Sustainable advantage	• Defensible position	• Temporary advantage	• Continuous flow of advantages
Performance driver (c)	• Unique firm competencies	• Industry structure	• Right moves	• Exploitation of firm-specific capabilities
Strategy process (d)	• Create a vision, build and exploit competencies to realize vision: strategic intent	• Pick an industry, pick a strategic position, fit the organisation	• Make the "right" competitive and collaborative moves	• Renew competencies to develop active congruence within changing environment
Fundamental unit of analysis (e)	• Resources	• Industries • Firms • Products	• Firm • Products	• Processes • Positions • Paths
Impact on strategy process (f)	• Strategy from inside-out	• Strategy from outside-in	• Instantaneous	• Recognise and exploit firm-specific paths and trajectories
Success (g)	• Long term dominance	• Profits	• Short-term gain	• Asset accumulation and inimitability

Figure 2: Aspects of the four generic models of strategic management

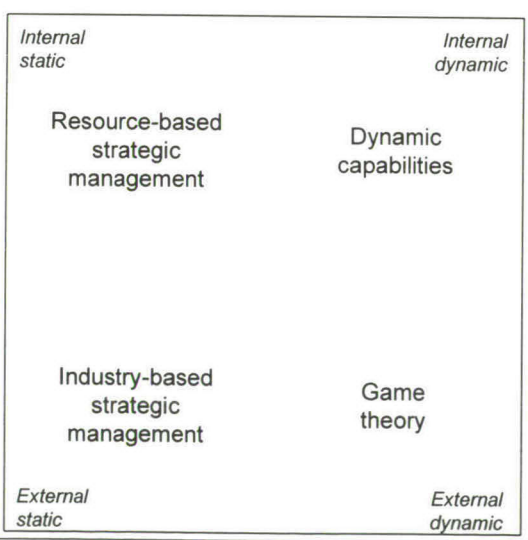

Figure 3: Positioning the four generic models of strategic management

large and their strategic interaction is emphasised. Firms are represented by their set of available strategic actions and their cost functions. The industrial organisation theories of the firm view the market structure in terms of number and size of firms as the principal determinants of firm conduct. A major development in the theory of industrial organisation is the study of competition between firms. The principal contribution of this study is the recognition that firms seek competitive strategies in response to the strategies of rival firms. Firms are aware of the effect of their actions on demand. The noncooperative game theory equilibrium can be applied to a wide variety of actions: pricing, contract terms, production, investment, advertising, R&D, product quality and other product characteristics.

Industry-based strategic management is directly related to the Harvard industrial organisation theory. Based on case studies by Mason, the Bain-Mason paradigm or structure-conduct-performance paradigm (Bain, 1968) was developed which states that industry structure determines the conduct of firms whose joint conduct determines their collective performance (Baaij, 1996) (Figure 4). Unlike the neo-classical theory, the Harvard industrial organisation theory stated that market control prevailed over competition. Porter imported the Harvard industrial organisation structure-conduct-performance paradigm into the SWOT framework of strategic management (Porter, 1980). The structure-conduct-performance paradigm implies that it is the industry structure that sets the conditions of a firm's performance.

The performance of the firm is a result of the industry's attractiveness and the firm's competitive position within that industry. Therefore, the essence of strategy is positioning the firm in its industry environment. Porter developed his competitive forces framework for industry analysis by identifying five basic competitive forces (Figure 5). The strength of each of the five forces is a function of the industry structure or the underlying economic and technical characteristics of an industry (Porter, 1990).

The collective strengths of the competitive forces determine the intensity of competition and the ultimate profit potential of the industry. The rules of competition are embodied in five competitive forces. The collective strength of

Figure 4: The structure-conduct-performance paradigm

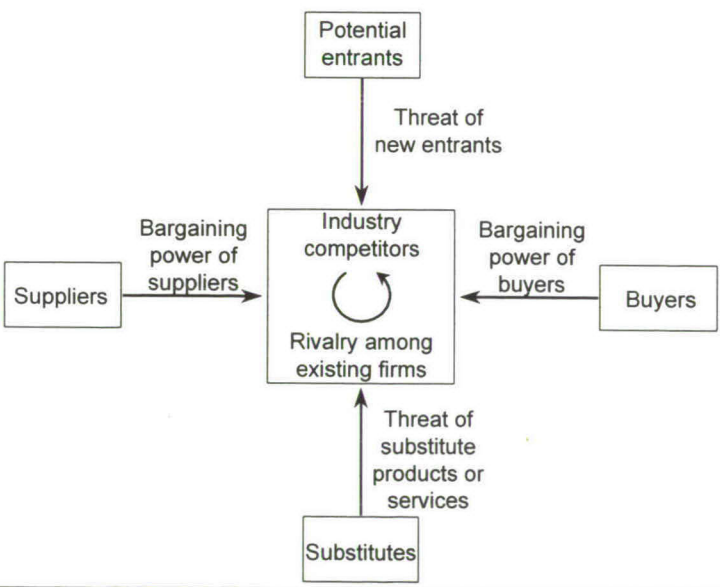

Figure 5: Competitive forces framework, by Porter

these five forces determines the ability of firms in an industry to earn, on average, rates of return on investment in excess of the cost of capital (Porter, 1985). The five forces driving industry competition are:

- The rivalry among existing competitors.
- The bargaining power of suppliers.
- The threat of new entrants.
- The threat of substitute products.
- The bargaining power of buyers.

The competitive forces framework provides an analysis of industry opportunities and threats and therefore the industry's attractiveness. Comparable to the Harvard industrial organisation theory, the competitive forces framework determines the strategy of a firm. Porter defines strategy as the analytical selection of an attractive industry and subsequent selection of a competitive position within the industry. A firm is usually not a prisoner of its industry structure. Firms, through their strategies, can influence the five forces. If a firm can shape structure it can fundamentally change an industry attractiveness for better or for worse (Porter, 1985). In addition, Porter identified three generic competitive strategies to obtain these competitive positions (Figure 6). The generic competitive strategies involve two choices.

The first choice is the selection of the basis of competition which may be either efficiency-driven or differentiation-driven or as Porter stated, choosing to perform different activities than rivals or choosing to perform activities differently (Porter, 1996). The second choice concerns the position the company has in the value system and the extent of the competition, which may be the whole market or just a niche. It was found that in most cases companies with an average market-share have a low return on investment (Porter, 1980). Porter states that companies have to choose a generic strategy, otherwise they will get stuck in the middle of the U-shape to avoid becoming caught in the inherent contradictions of different strategies (Figure 7) (Porter, 1985). Competitive position and competitive advantage are based on a firm's ability

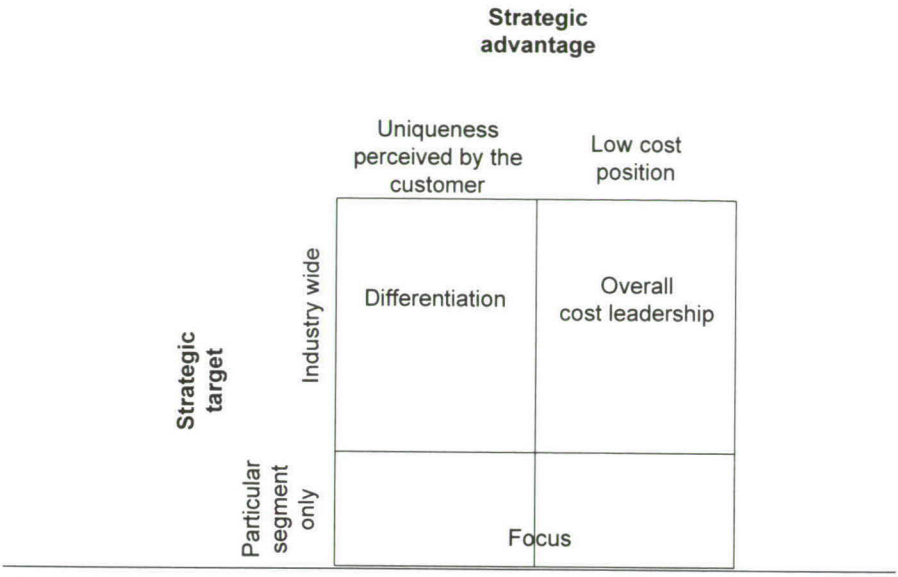

Figure 6: Generic competitive strategies, by Porter

to cope with competitive forces better than its rivals. The basis of competitive advantage is the distinctive ability of a firm to align itself with the industry environment. By developing the concept of the value chain a firm is able to analyse what activities should be related to what products in order to create a sustainable strategic advantage.

Porter developed a theory of industry-based strategic management. His contribution to strategic management theory could be described as industry-based strategic management and uses an outside-in strategy process (Figure 8). The industry strategy resource paradigm defines the following sequences of strategy formulation:

- domain selection;
- competitive forces framework;
- domain navigation,
- by using the generic competitive strategies framework a firm can select a competitive position within the industry;

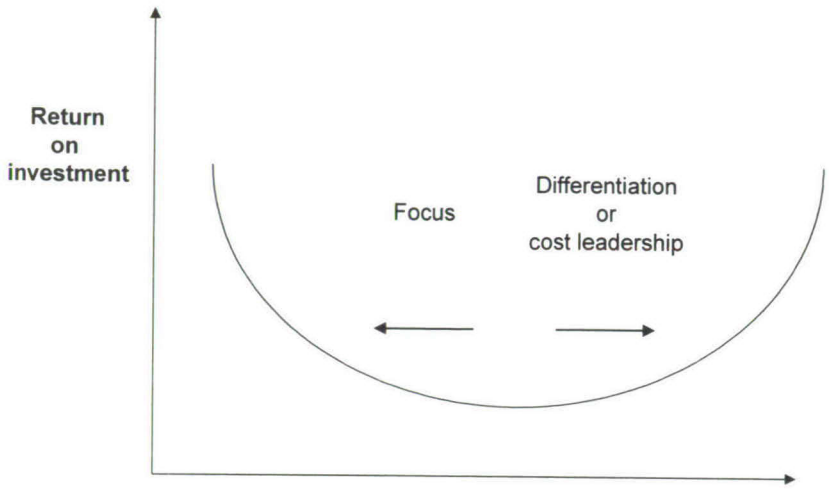

Figure 7: Stuck in the middle, by Porter

- activity configuration,
- after strategy formulation, by using the value chain a firm can translate strategy into action by selecting resources and the required activities.

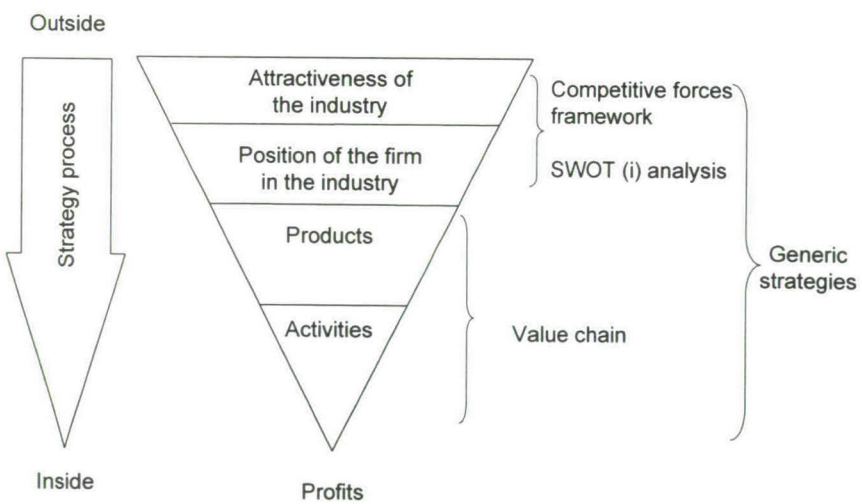

Figure 8: Strategy process of industry-based strategic management

B.2 Resource-based strategic management

Contrary to industry-based strategic management, resource-based strategic management implies that firm-specific factors are the major determinants of performance differences between firms in the same sector (Cool and Schendel, 1988). As a result the firm itself is the main domain of study. The firm is organised as a means of mitigating the effects of uncertainty regarding production and final demand. Clearly, market contracts in agency relationships and within the firm are subject to moral problems. Contractual theories of the firm can be used to analyse the relative efficiencies of information processing in market relationships versus organisational relationships. Activities will take place within the firm when relationships within the organisation handle information more effectively than market contracts. Asymmetric information and bounded rationality (Cyert and March, 1963) cause information imperfections and lead to opportunities (Williamson, 1975).

The resource perspective has a long history, starting with Marshall using three resources, i.e. land, labour and capital. It was Selznick in the 1950s who developed a resource-based view of the firm, stressing that competencies are the source of competitive advantage (Collis and Montgomery, 1995). Later Penrose defined a company as a '*bundle of competencies*' (Penrose, 1959) or as a configuration of technology and organisation (Foss and Knudsen, 1996; Penrose, 1959). The firm is made up of a number of resources, consisting of assets, competencies and positional advantages embodied in various forms of capital (financial, human, social, commercial). Contrary to assets, competencies and positional advantages are not subject to ownership and contracts. Competencies refer to abilities and knowledge in the sense of know-how and are merely a group of skills, experiences and technologies rather than a single, discrete skill or technology (Nelson and Winter, 1982). Competencies are firm-specific and unique and cannot be bought outside the company but have to be developed. They are the result of combining different organisational resources and their related knowledge and experiences. Besides competencies, capabilities can also be identified as essential to the resource perspective (Stalk et al, 1992). According to Teece (Teece et al, 1997) capabilities can be related to product and process development, technology transfer, intellectual property, manufacturing, human resources and organisational learning. Stalk et al (Stalk

et al, 1992) make a distinction between core competencies and core capabilities. Core competencies are defined as emphasising technological and production expertise at specific points along the value chain. Core capabilities are more broadly based, encompassing the entire value chain. In this respect core capabilities are visible to the customer in a way core competencies rarely are. As a result, the existence and development of core capabilities make it possible for the firm to gain benefits based on its positional advantages such as strong brand loyalty (Haughey, 1997; Reichheld, 1993; 1996a; 1996b) and a good reputation. The positional advantages are related to competitors, customers, employees, shareholders and partners (Stoelhorst, 1997), (Figure 9).

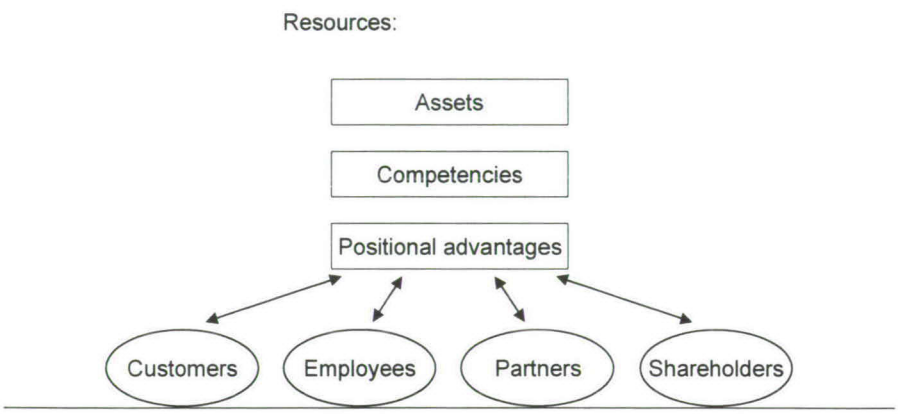

Figure 9: Definition of resources

Prahalad and Hamel contributed a great deal to the current popularity of a resource-based view of the firm by developing the concept of core competencies (Hamel and Prahalad, 1994; Prahalad and Hamel, 1991). The source of competitive advantage is the management's ability to consolidate corporate-wide technologies and production skills into competencies that enable individual businesses to adapt quickly to changing opportunities (Prahalad and Hamel, 1990). According to Prahalad (Prahalad, 1991) companies have to bridge the performance gap (related to operational aspects and restructuring) as well as the opportunity gap (related to strategic direction and revitalisation) to create value (Figure 10).

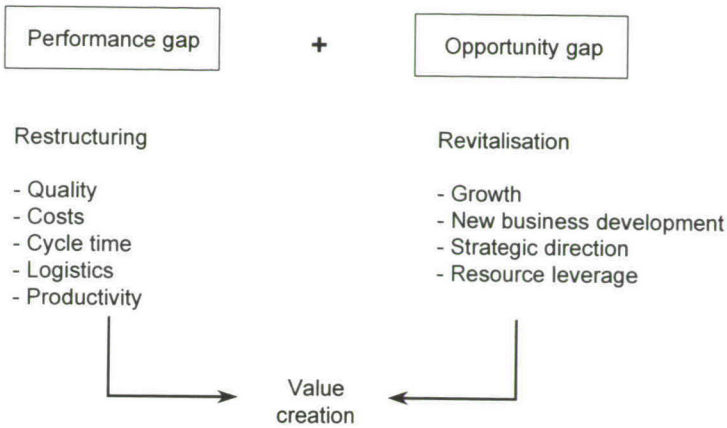

Figure 10: Performance and opportunity gap, by Prahalad and Hamel

The strategy orientation is therefore a mixture of leveraging and stretching the corporate resources to such a level that new businesses can be created (Hamel and Prahalad, 1993). Management can leverage its resources in five basic ways: by concentrating more effectively on key strategic goals; by accumulating them more efficiently; by complementing one kind of resource with another to create a higher order value; by conserving resources wherever possible; and by recovering them from the market place in the shortest possible time (Hamel and Prahalad, 1993). Besides a certain framework for the company's possibilities, a strategic intent has to be developed to create a path leading to the defined new business space (Hamel and Prahalad, 1994), (Figure 11).

Resources are the factors for production and dictate the supply or the transformation process. This means that resources can be tangible as well as intangible, human as well as physical. The strategy process from a resource-based strategic management perspective therefore has an '*inside-out*' orientation (Figure 12).

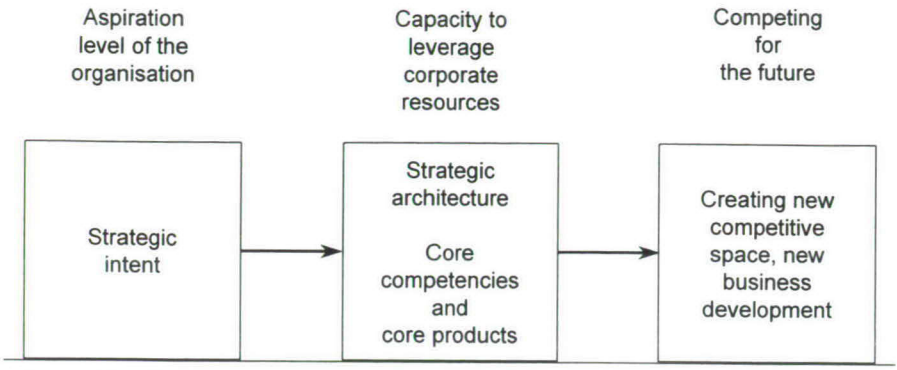

Figure 11: From strategic intent to competing for the future by Prahalad and Hamel

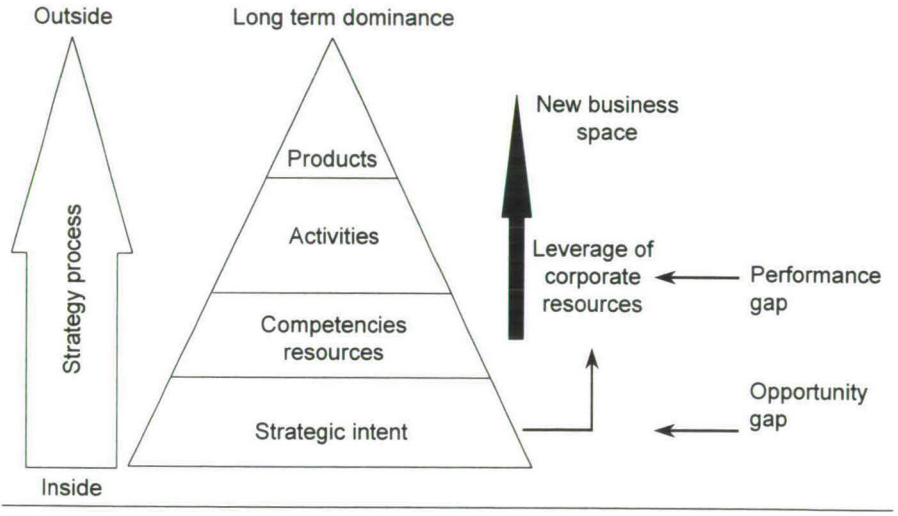

Figure 12: Strategy process of resource-based strategic management

Annex C: Comprehensive literature study of programmes related to the production process

A comprehensive literature study was carried out to find the empirical results of other authors who studied new programmes related to the process of production during the 80s and 90s. Based on this review, five distinctive programmes were found that have influenced the production process over the last two decades.

These five programmes are:

- Just-in-Time (JIT)
- Total Quality Management (TQM)
- Business Process Re-engineering (BPR)
- Lean production (LP)
- Mass customisation (MC)

The five programmes are analysed according to the outcome of the implementation of the specific programme in relation to the process of production and the process of value creation. The analysis of these five programs is based on meta-studies of these specific programmes, however, no meta-studies on mass customisation were found. The meta-studies were selected from several databases using the name of the specific programmes and the terms "*meta*", "*empirical*" or "*literature review*". The second criterion is that the studies found should have been published after 1995. This provided an up-to-date and comprehensive overview of the different programmes. Based on this search, fourteen articles were selected (Figure 1). Most of the selected articles, almost half, were published in the International Journal of Operations & Production Management (IJOP), almost no articles were found in 'A' journals concerned with strategic management.

Journals	Number of citations
Administrative Science Quarterly	1
Business Process Management	1
Industrial Management & Data Systems	1
International Journal of Operations & Production Management	5
Management Science	2
Organization Studies	1
Production and Inventory Management Journal	2
Strategic Management Journal	1

Figure 1: Journals concerned with strategic management

As might be expected, more articles were found on the more advanced programmes over the years, such as JIT and BPR. Only one empirical overview article was found on the subject of mass customisation.

Author(s)	Year published	Programme covered
Al-Mashari and Zairi	1999	Business Process Re-engineering
Åhlström and Westbrook	1999	Mass Customisation
Brown	1998	Lean Production
Guimaraes and Bond	1996	Business Process Re-engineering
Hackman and Wageman	1995	Total Quality Management
Hendricks and Singhal	1997	Total Quality Management
Lowe, Delbridge and Oliver	1997	Lean Production
MacDuffie, Sethuraman and Fisher	1996	Lean Production
O'Neill and Sohal	1998	Business Process Re-engineering
Powell	1995	Total Quality Management
Ramarapu, Mehra and Frolick	1995	Just-in-Time
Spencer and Guide	1995	Just-in-Time
Vokura and Davis	1996	Just-in-Time
Zhu, Meredith and Makboonprasith	1994	Just-in-Time

Figure 2:Articles on the more advanced programmes

First, a short overview of the background to aims and methods of the different programmes is presented.

- Just-in-Time

The Just-in-Time programme was originated by the founder of the Toyota Motor Company, Kiichiro Toyota. The first articles started to appear at the end of the 1970s (The first one in the US was Sugimori, Kusunoki and Uchikawa, 1977). It was not until the early 1980s that JIT implementation articles began to appear in large numbers in professional journals. According to a survey of the future of manufacturing done by Cooper & Lybrand's Manufacturing Consulting Group in 1987, the percentage of companies using JIT would exceed 55% in 1992. The goal of the JIT-programme is a continuous goal-oriented process to eliminate waste and improve productivity (Zhu et al, 1994).

Some empirical evidence suggests that JIT must be implemented as a total system otherwise it will not achieve company-wide improvements to increase the organisation's competitiveness (Benson, 1986). The review of JIT literature by Ramarapu et al (Ramarapu et al, 1995) identified 105 JIT implementation research articles published in professional journals since 1980. They found that most researchers took the same approach, interviewing one manager in each two or three companies and generalising some critical success factors based on their answers. The benefits of JIT are reported as inventory reduction, increased quality, better labour and equipment utilisation, lead time reduction and increased inventory turnover. Spencer and Guide (Spencer and Guide, 1995) found in their survey of 42 JIT articles that JIT education is a crucial factor in JIT implementation. Other factors that they found were: quality circles, set-up time reduction, and cross training. They could not find any difference between the findings of practitioners and academics (disregarding their respective ranks). They remarked that there are only a few studies on the correlation between the elements from a quantitative point of view.

- Total Quality Management

The core concept of TQM came from Deming (Deming, 1986), Juran (Juran, 1969; 1974; 1988) and Ishikawa (Ishikawa, 1985). In short, TQM tries to enhance organisational effectiveness. The main authors specify four principles that guide any actions intended to improve quality: focus

on work processes, analysis of variability, management by fact and learning and continuous improvement.

A study by Arthur D. Little corporation in 1992 reported that 93% of America's largest companies had adopted TQM in some form (Arthur D. Little, 1992). Due to measurement problems, exogenous disturbances and temporal issues, intervention-outcome relationships are obscured and empirical studies have great difficulty in obtaining a direct relationship between TQM and long-term effectiveness. The general outcomes reported can be categorised in three areas: TQM improved the error-rate, decreased the time needed to complete a process and improved dollar savings from process efficiencies. TQM research has focused largely on global outcomes. The results are positive but mostly based on case study reports. Recently, articles with numerical measurements have started to appear. Haim (Haim, 1993) summarised the results of 20 different empirical studies on TQM. Only three of the 20 studies report any kind of numerical measurement of the profitability impact of TQM. Twelve of these studies relied solely on the perceptions of managers. Recently, Powell (Powell, 1995) found that the mean (median) change in the operating income of successful TQM companies is 107% (48%) higher than his control sample. Hendricks and Sinhhal (Hendricks and Sinhhal, 1996) showed that stock price reacts positively to winning a quality award. Heller (Heller, 1994) reported that a portfolio of 150 TQM companies showed a significant abnormal change of 4.95% in stock prices between the years 1989-1992.

- Business Process Re-engineering

The roots of BPR can be traced back to the publications of Hammer (Hammer, 1990) and Davenport & Short (Davenport and Short, 1990). BPR is the fundamental re-thinking and radical re-design of business processes to achieve dramatic improvements in critical measurements of performance, such as cost, quality, service and speed (Hammer and Champy, 1993). From various articles, Al-Mashari and Zairi (Al-Mashari and Zairi, 1999) distilled five dimensions of change related to BPR implementation: change management; management competency and

support; organisational structure; project planning and management and IT infrastructure.

A Price Waterhouse survey of the manufacturing industry in the mid-Atlantic region reported that more than 80% of the respondents were in the planning stage or seriously considering re-engineering (Goll and Cordovano, 1993). The small number of empirical studies on the application of BPR among businesses show conflicting results, apart from the success stories of Eastman-Kodak and AT&T (Teng et al, 1994) there have been the studies by Deloite and Touche (Moad, 1993) and Hamer and Champy (Hammer and Champy, 1993) which concluded that most projects fall short of their expected benefits.

- Lean production

The term *lean production* was first used in Womack, Jones and Roos (Womack et al, 1990). MacDuffie (MacDuffie, 1991, 1995; MacDuffie et al, 1996) introduced the link between performance and lean production. Three generic bundles of organisational practices should lead to better manufacturing performance: factory practices, work systems, and human resource management. The main exponents of lean production are those using low buffers and right first time production. According to Brown (Brown, 1998), in order for lean production to be a success senior management must see quality in terms of a wide range of capabilities and not just prevention of defects and cost reduction. Lowe et al (Lowe et al, 1997) found that it was the factory practices in particular which contributed to an increase in productivity. There is conflicting evidence about the effects of the other two practices. According to a study of 71 plants by Delbridge, Lowe and Oliver (Delbridge et al, 1995) a combination of scale (volume), capacity utilisation and automation explain the higher performance of a car plant. MacDuffie (MacDuffie et al, 1996) found partial support for their hypothesis that "*management policies, in both operations and human resource areas, can facilitate the absorption of higher levels of product variety, i.e. that "lean production" plants are capable of handling higher levels of product variety with less*

adverse effects on total labour productivity than traditional "mass production" plants".

- Mass customisation

  The latest programme is "*mass customisation*". Initially it was used as a term to describe a trend towards the production and distribution of individually customised goods and services for a mass market (Davis, 1987). The topic of mass customisation was first explored by Pine (Pine II, 1993; Pine II and Gilmore, 1997). Being a relatively new concept, the literature on mass customisation is predominantly prescriptive or based on single case studies. Ålström and Westbrook (Ålström and Westbrook, 1999) identified seven methods companies can use for current and future product customisation: assembly of core modules, materials processing, increasing stock range, making products self-customising, information content modification, another company providing services around the product, and retailer providing services around the product.

  Ålström and Westbrook (Ålström and Westbrook, 1999) surveyed 200 companies from whom 40 usable responses were returned. They concluded that the benefits of increased product customisation seem to be related to the customer and the market impact more than to costs and profit. More than half of the companies studied had already implemented at least one of the following programmes: TQM, JIT, cellular manufacturing, BPR and benchmarking.

The five programmes can be characterised by their impact on the processes of the company and value creation. Based on the above review of the five programmes, a summary has been drawn up (Figure 3).

Two conclusions can be drawn. As was observed in the discussion of mass customisation, most companies had implemented at least two or three of the programmes which led to the conclusion that the five programmes are interdependent. This interdependence of the different programmes illustrates the need for a comprehensive and complete view of the company's processes.

Programme	Goal	Empirical relationship between the programme and the firm's performance
Just-in-Time (JIT)	Eliminate waste increase productivity	None
Total Quality Management (TQM)	Improve quality of products and services	Positive
Business Process Re-engineering (BPR)	Overall improvement	None/negative
Lean Production	Low buffers	None/positive
Mass Customisation	Provide customised products	Not yet clear

Figure 3: Summary of the five programmes

Secondly, it is clear that a complete and comprehensive study of the relationship between the programmes and a company's performance is generally lacking. A different framework is needed to analyse the production process and its relationship with the value creation process.

Within these boundaries the value chain concept can be implemented under the resource imperative since the strategy process is part of the process of forming the company's perspective and the process of forming resources. The five developments in the production process examined here can be positioned using the concept of the value chain (Figure 4).

Programme	Goal	Focus	Impact on value chain
Just-in-Time (JIT)	Eliminate waste increase productivity	Labour and equipment utilisation	Primary: • inbound logistics • operations • outbound logistics
Total Quality Management (TQM)	Improve quality of products and services	Work processes	Support: • human resource management
Business Process Re-engineering (BPR)	Improve firm's performance	Re-designing all the company processes	Primary and Support
Lean Production	Low buffers and first time production	Factory practices and work systems	Primary: • operations
Mass Customisation	Provide customised consumer products	Re-designing all the company processes	Primary and Support

Figure 4: The five programmes and their impact on the value chain

Annex D: Glossary

Added value strategy
An added value strategy implies the aim to continuously increase the added value per unit turnover. This strategy has several similarities with the Porterian strategy of differentiation since both strategies have a focus on delivering premium value for the customer at a premium price. This premium value can be related to design, branding, product quality, customer service, or dealer network. A successful deployment of an added-value strategy implies a trade-off between the premium price the customer is willing to pay and the increased cost of development as the result of extensive research, product design and intensive customer support to gain additional margins.

Ambidextrous companies
Ambidextrous companies are able to successfully balance exploitation and exploration. Finding a balance is realised through balancing both stability and incremental innovation in exploitation and stability and radical innovation on exploration.

Core stakeholders
Core stakeholders are groups of customers, employees, partners and shareholders of a company that have mutually accepted relationships with the company. These groups have a direct impact on the wealth and prospects of the company. The frequency, dynamics and content of the interaction between the different groups of core stakeholders and the company form the identity of the company.

Efficiency strategy
An efficiency strategy implies the aim to continuously reduce costs per unit turnover and as a result increase value per unit turnover. Choosing an efficiency-strategy leads to a focus on economies of scale, bringing down the experience curve and reducing overhead.

Exploitation
Exploitation uses a short time horizon and focuses on the configuration of elements related to alignment, refinement and selection based on current

experiences derived from the process of production and the production configuration process. The configuration of the elements of the production process and the production configuration process can be made visible by using the concept of the value chain. Exploitation is similar to first order or single loop learning and concentrates on the existing core stakeholders of the company.

Exploration

Exploration uses a long time horizon and focuses on search, variation, experimentation and risk-taking in order to discover new opportunities and new core stakeholders of the company related to the defined new opportunities. Defining new opportunities and related core stakeholders can be defined as the process of forming the company's perspective and the process of forming resources. The relation between the different core stakeholders and the development of resources can be made visible by analysing the factor productivity and the total factor productivity of the different core stakeholders. Exploration is similar to second order or double loop learning.

Generic firm processes

Generic firm processes describe all the major activities within a company. Five major processes are identified: the process of forming the company's perspective, the process of forming resources, the process of production configuration, the production process and the value creation process. These processes are intertwined and form a hierarchy based on the stability of these processes.

High order

High order is a high hierarchical order based on the core beliefs of the company and is a set of coherent implicit and explicit choices, which form the basic configuration of the company. The process of forming the company's perspective and the process of forming resources are the two most stable processes and therefore form the high order of a company.

Incremental innovation

Incremental innovation implies a change of scope in the relationship between the production process and the value creation process and is hence related to

exploitation. Through defining generic strategies (which are related to the concept of the value chain) incremental innovation (defined as a change of generic strategy) can be made visible. Incremental innovation does not imply that the process of change itself is incremental but only implies a change of scope in exploitation.

Resources

Resources are the production factors and dictate the supply or the transformation process. This means that resources can be tangible as well as intangible, human as well as physical. Following Stoelhorst (Stoelhorst, 1997) resources are defined as assets, competencies and positional advantages. Competencies refer to abilities and knowledge in the sense of know-how and are a group of skills, experiences and technologies rather than a single, discrete skill or technology. Positional advantages are related to competitors, customers, employees, shareholders and partners.

Radical innovation

Radical innovation implies a change of scope in the company's perspective and the process of forming resources and is related to exploration. A different perspective will lead to a different coalition of core stakeholders and a different process of forming resources. Radical innovation does not imply that the process of change itself is radical but only implies a change of scope on exploration.

Stability in exploitation

Stability implies that more than half of the development of the total operational value of a company can be related to a single generic strategy. The three generic strategies are: efficiency strategy, added value strategy or a volume strategy.

Stability in exploration

Continuity of the high order or the perspective of a company and hence continuity of the different core stakeholders in relation to the company. A continuity of both the company's perspective and the different core stakeholders result in a longitudinal continuous build-up of total resource productivity.

Volume strategy

A volume strategy implies the aim to continuously increase the level of turnover without changing the added value per unit turnover or company specific cost-ratio per unit turnover.

Company name	Abbreviation	Initial year	Last year	Size	Industry
Aalberts Industries NV	Aalberts	1985	1997	SC	PhP
ABN AMRO Holding N.V.	ABN	1985	1997	AEX	Ser
ACF Holding NV	ACF	1985	1997	SC	PhP
AEGON NV	Aegon	1985	1997	AEX	Ser
Koninklijke Ahold nv	Ahold	1985	1997	AEX	D&C
Koninklijke Ahrend NV	Ahrend	1985	1997	MC	D&C
Akzo Nobel NV	Akzo	1985	1997	AEX	PhP
Atag Holding NV	Atag	1986	1997	SC	PhP
Athlon Groep NV	Athlon	1985	1997	SC	D&C
Koninklijke BAM Groep NV	BAM	1985	1997	SC	PhP
Batenburg Beheer NV	Batenburg	1985	1997	SC	Ser
Beers NV	Beers	1985	1997	SC	D&C
Koninklijke Begemann Groep NV	Begemann	1985	1997	SC	PhP
Blydenstein-Willink NV	Blydenstein	1985	1997	SC	PhP
De Boer Unigro NV	Boer	1986	1997	SC	D&C
Koninklijke BolsWessanen NV	Bols	1985	1997	MC	PhP
Koninklijke Boskalis Westminster NV	Boskalis	1985	1997	SC	PhP

Key: Size: SC = Smallcap, MC = Midcap; Industry: PhP = Physical production, Ser = Service, D&C = Distribution and Communication

Company name	Abbreviation	Initial year	Last year	Size	Industry
CAP Gemini NV	CAP	1986	1997	MC	Ser
Koninklijke Ten Cate NV	Cate	1985	1997	SC	PhP
Cindu International NV	Cindu	1986	1997	SC	PhP
Content Beheer NV	Content	1985	1997	SC	Ser
CSM NV	CSM	1985	1997	MC	PhP
Delft Instruments NV	Delft	1985	1997	SC	PhP
De Drie Electronics Beheer NV	Drie	1985	1997	SC	Ser
Reed Elsevier	Elsevier	1985	1997	AEX	D&C
Gamma Holding NV	Gamma	1985	1997	SC	D&C
Gelderse Papiergroep NV	Gelderse	1985	1997	SC	PhP
Getronics NV	Getronics	1985	1997	MC	Ser
Geveke NV	Geveke	1985	1997	SC	Ser
Van der Giessen-de Noord N.V.	Giessen	1985	1996	SC	PhP
Koninklijke Gist-Brocades N.V.	Gist	1985	1997	SC	PhP
Koninklijke Grolsch NV	Grolsch	1985	1997	SC	PhP
Grontmij nv	Grontmij	1985	1997	SC	PhP
NV GTI Holding	GTI	1985	1997	SC	Ser

Key: Size: SC = Smallcap, MC = Midcap; Industry: PhP = Physical production, Ser = Service, D&C = Distribution and Communication

Company name	Abbreviation	Initial year	Last year	Size	Industry
Hagemeyer NV	Hagemeyer	1985	1997	AEX	D&C
HBG, Hollandsche Beton Groep NV	HBG	1985	1997	SC	PhP
Heineken NV	Heineken	1985	1997	AEX	PhP
Koninklijke Hoogovens NV	Hoogovens	1985	1997	AEX	PhP
Hunter Douglas NV	Hunter	1985	1997	MC	PhP
IHC Caland NV	IHC	1985	1997	MC	PhP
Internatio-Müller NV	IM	1985	1997	MC	Ser
ING Groep N.V.	ING	1988	1997	AEX	Ser
Kas-Associatie NV	KAS	1985	1997	SC	Ser
NV Koninklijke Bijenkorf Beheer KBB	KBB	1985	1997	SC	D&C
Kempen & Co NV, Merchant bank	Kempen	1986	1997	SC	Ser
Koninklijke Luchtvaart Maatschappij NV	KLM	1985	1997	AEX	D&C
NV Koninklijke KNP BT	KNP-BT	1985	1997	SC	D&C
Koninklijke Landré en Glinderman NV	Landre	1985	1997	SC	Ser
LCI Computer Group NV	LCI	1987	1997	SC	Ser
Koninklijke Frans Maas Groep NV	Maas	1986	1997	SC	D&C
Macintosh Retail Groep NV	Macintosh	1985	1997	SC	D&C

Key: Size: SC = Smallcap, MC = Midcap; Industry: PhP = Physical production, Ser = Service, D&C = Distribution and Communication

Company name	Abbreviation	Initial year	Last year	Size	Industry
Van Melle NV	Melle	1985	1997	SC	PhP
Bank Mendes Gans NV	Mendes	1985	1997	SC	Ser
NBM-Amstelland NV	NBM	1985	1997	MC	PhP
NV Nederlandsche Apparatenfabriek Nedap	NEDAP	1985	1997	SC	PhP
Koninklijke Nedlloyd NV	Nedlloyd	1985	1997	MC	D&C
Neways Electronics International NV	Neways	1985	1997	SC	Ser
De Nationale Investeringsbank nv	NIB	1986	1997	SC	Ser
NKF HOLDING NV	NKF	1986	1997	SC	PhP
Norit NV	Norit	1985	1997	SC	PhP
NV Verenigde Bedrijven Nutricia	Nutricia	1985	1997	AEX	PhP
Océ NV	Oce	1985	1997	AEX	PhP
Koninklijke Van Ommeren NV	Ommeren	1988	1997	MC	D&C
Otra NV	Otra	1985	1997	SC	Ser
P&C Groep NV	P&C	1985	1997	SC	D&C
Koninklijke Pakhoed NV	Pakhoed	1985	1997	MC	D&C
Philips Electronics NV	Philips	1985	1997	AEX	PhP
PolyGram NV	Polygram	1988	1997	SC	D&C

Key: Size: SC = Smallcap, MC = Midcap; Industry: PhP = Physical production, Ser = Service, D&C = Distribution and Communication

Company name	Abbreviation	Initial year	Last year	Size	Industry
Polynorm NV	Polynorm	1985	1997	SC	PhP
Rood Testhouse International NV	Rood	1986	1997	SC	Ser
Samas-Groep NV	Samas	1985	1997	SC	D&C
Schuitema NV	Schuitema	1985	1997	SC	D&C
Koninklijke / Shell Groep	Shell	1985	1997	AEX	PhP
Simac Techniek NV	Simac	1985	1997	SC	Ser
Smit Internationale NV	Smit	1985	1997	SC	D&C
NV Koninklijke Sphinx Gustavsberg	Sphinx	1985	1997	SC	PhP
Stork NV	Stork	1985	1997	MC	PhP
NV Holdingmaatschappij De Telegraaf	Telegraaf	1985	1997	SC	D&C
Tulip Computers NV	Tulip	1985	1996	SC	PhP
NV Twentsche Kabel Holding	Twentsche	1985	1997	SC	PhP
Unilever	Unilever	1985	1997	AEX	PhP
NV Verenigd Bezit VNU	VNU	1985	1997	AEX	D&C
Vredestein NV	Vredestein	1985	1997	SC	PhP
Wegener Arcade NV	Wegener	1985	1997	SC	D&C
Wolters Kluwer NV	Wolters	1986	1997	AEX	D&C

KEY: Size: SC = Smallcap, MC = Midcap; Industry: PhP = Physical production, Ser = Service, D&C = Distribution and Communication

Name	Categorisation	Sum of Boolean Consistency * Impact			
		ci(V)	ci(E)	ci(A)	ci(P)
Aalberts	Focus on added value	8	3	8	2
ABN	Focus on efficiency	3	7	3	5
ACF	Focus on efficiency	2	9	1	4
Aegon	Focus on added value	7	2	7	4
Ahold	Focus on added value	6	2	10	3
Ahrend	Focus on efficiency	2	8	2	6
Akzo	Incremental innovation	2	4	5	5
Atag	Focus on volume	9	5	4	0
Athlon	Incremental innovation	5	5	3	2
BAM	Focus on efficiency	5	7	4	5
Batenburg	Incremental innovation	5	4	5	5
Beers	Focus on added value	5	3	7	6
Begemann	Focus on added value	6	3	7	5
Blydenstein	Incremental innovation	0	0	6	5
Boer	Incremental innovation	3	2	6	6
Bols	Focus on added value	1	0	8	5
Boskalis	Incremental innovation	5	6	4	4
CAP	Incremental innovation	4	4	2	2
Cate	Incremental innovation	2	4	3	4
Cindu	Incremental innovation	3	3	5	2
Content	Focus on volume	8	6	5	2
CSM	Focus on volume	7	4	5	2
Delft	Incremental innovation	1	5	4	7
Drie	Incremental innovation	3	4	6	2
Elsevier	Focus on added value	5	2	8	7
Gamma	Incremental innovation	3	3	5	5
Gelderse	Incremental innovation	3	3	4	5
Getronics	Focus on volume	11	3	7	1
Geveke	Incremental innovation	5	6	4	4

Name	Categorisation	Sum of Boolean Consistency * Impact			
		ci(V)	ci(E)	ci(A)	ci(P)
Giessen	Incremental innovation	5	5	5	4
Gist	Incremental innovation	2	4	6	5
Grolsch	Incremental innovation	5	5	5	5
Grontmij	Incremental innovation	5	6	6	6
GTI	Focus on added value	3	4	7	7
Hagemeyer	Focus on volume	10	3	7	0
HBG	Focus on efficiency	4	7	5	3
Heineken	Incremental innovation	4	5	5	5
Hoogovens	Incremental innovation	1	4	3	5
Hunter	Focus on added value	2	1	7	5
IHC	Incremental innovation	5	6	4	4
IM	Incremental innovation	2	6	4	6
ING	Focus on volume	6	3	5	3
KAS	Incremental innovation	1	5	3	4
KBB	Incremental innovation	2	4	6	5
Kempen	Incremental innovation	5	4	4	3
KLM	Focus on added value	0	0	9	7
KNP-BT	Incremental innovation	4	3	4	4
Landre	Incremental innovation	4	3	5	3
LCI	Incremental innovation	5	3	5	3
Maas	Incremental innovation	4	4	3	2
Macintosh	Incremental innovation	2	1	4	5
Melle	Incremental innovation	5	4	6	4
Mendes	Focus on added value	1	4	7	5
NBM	Incremental innovation	5	6	5	5
NEDAP	Focus on volume	9	7	4	1
Nedlloyd	Incremental innovation	2	4	5	4
Neways	Focus on volume	8	2	5	2
NIB	Focus on volume	7	4	6	1
NKF	Incremental innovation	4	5	5	2

Name	Categorisation	Sum of Boolean Consistency * Impact			
		ci(V)	ci(E)	ci(A)	ci(P)
Norit	Incremental innovation	6	6	3	2
Nutricia	Incremental innovation	6	4	6	4
Oce	Incremental innovation	5	5	2	1
Ommeren	Focus on added value	0	2	7	8
Otra	Focus on added value	6	2	7	4
P&C	Incremental innovation	1	3	3	3
Pakhoed	Incremental innovation	5	4	6	4
Philips	Incremental innovation	0	4	4	4
Polygram	Focus on volume	6	5	3	1
Polynorm	Focus on volume	7	5	5	1
Rood	Incremental innovation	4	4	4	3
Samas	Focus on efficiency	6	7	2	1
Schuitema	Incremental innovation	3	4	6	5
Shell	Incremental innovation	2	5	5	3
Simac	Incremental innovation	6	4	6	2
Smit	Incremental innovation	2	2	6	6
Sphinx	Focus on added value	3	2	8	4
Stork	Incremental innovation	4	5	6	5
Telegraaf	Focus on added value	2	4	8	5
Tulip	Focus on volume	7	6	0	1
Twentsche	Focus on volume	7	4	5	4
Unilever	Incremental innovation	3	6	4	4
VNU	Incremental innovation	5	3	6	4
Vredestein	Incremental innovation	1	3	5	5
Wegener	Focus on added value	5	5	7	6
Wolters	Focus on added value	4	4	7	4

Name	Categorisation	Beta	R^2	Period
Aalberts	Stable damped build-up	0.019	0.749	Negative period
ABN	Stable continous build-up	0.062	0.967	Neutral period
ACF	Stable damped build-up	0.039	0.764	Negative period
Aegon	Damped build-up	0.036	0.603	Negative period
Ahold	Moderate build-up	0.012	0.538	Positive period
Ahrend	Marginal build-up	0.033	0.812	Positive period
Akzo	Stable continous build-up	0.027	0.869	Neutral period
Atag	Unstable continous teardown	-0.002	0.011	Neutral period
Athlon	Moderate build-up	0.088	0.580	Positive period
BAM	Stable damped build-up	0.028	0.816	Negative period
Batenburg	Stable continous build-up	0.033	0.950	Neutral period
Beers	Unstable damped build-up	0.012	0.076	Negative period
Begemann	Moderate teardown	-3.640	0.520	Negative period
Blydenstein	Damped build-up	0.062	0.541	Negative period
Boer	Stable damped build-up	0.031	0.770	Negative period
Bols	Unstable damped build-up	0.009	0.227	Negative period
Boskalis	Stable damped build-up	0.030	0.734	Negative period
CAP	Unstable damped teardown	-0.001	0.004	Positive period
Cate	Stable damped build-up	0.046	0.824	Negative period
Cindu	Stable damped build-up	0.026	0.902	Negative period
Content	Moderate continous teardown	-0.084	0.648	Neutral period
CSM	Stable continous build-up	0.037	0.963	Neutral period
Delft	Stable continous build-up	0.068	0.753	Neutral period
Drie	Unstable damped build-up	0.042	0.341	Negative period
Elsevier	Stable damped build-up	0.044	0.712	Negative period
Gamma	Unstable continous build-up	0.001	0.009	Neutral period
Gelderse	Unstable continous build-up	0.016	0.267	Neutral period
Getronics	Stable continous build-up	0.034	0.927	Neutral period
Geveke	Moderate continous build-up	0.034	0.573	Neutral period

Name	Categorisation	Beta	R^2	Period
Giessen	Stable continous build-up	0.080	0.754	Neutral period
Gist	Damped build-up	0.022	0.436	Negative period
Grolsch	Stable continous build-up	0.044	0.719	Neutral period
Grontmij	Moderate build-up	0.009	0.423	Positive period
GTI	Stable continous build-up	0.028	0.957	Neutral period
Hagemeyer	Damped build-up	0.031	0.570	Negative period
HBG	Stable continous build-up	0.028	0.941	Neutral period
Heineken	Stable continous build-up	0.057	0.979	Neutral period
Hoogovens	Damped build-up	0.050	0.628	Negative period
Hunter	Unstable damped teardown	-0.010	0.112	Positive period
IHC	Damped build-up	1.346	0.484	Negative period
IM	Stable continous build-up	0.038	0.761	Neutral period
ING	Stable continous build-up	0.075	0.979	Neutral period
KAS	Moderate continous build-up	0.028	0.552	Neutral period
KBB	Radical teardown	-0.003	0.014	Negative period
Kempen	Radical build-up	0.060	0.323	Positive period
KLM	Moderate build-up	0.045	0.435	Positive period
KNP-BT	Damped build-up	0.219	0.685	Negative period
Landre	Unstable continous build-up	0.015	0.303	Neutral period
LCI	Unstable damped teardown	-0.017	0.092	Positive period
Maas	Stable continous build-up	0.029	0.858	Neutral period
Macintosh	Stable damped build-up	0.104	0.788	Negative period
Melle	Stable damped build-up	0.045	0.781	Negative period
Mendes	Stable damped build-up	0.026	0.858	Negative period
NBM	Stable continous build-up	0.045	0.964	Neutral period
NEDAP	Stable continous build-up	0.042	0.981	Neutral period
Nedlloyd	Unstable continous build-up	0.016	0.101	Neutral period
Neways	Moderate build-up	0.022	0.555	Positive period
NIB	Stable continous build-up	0.063	0.938	Neutral period

Name	Categorisation	Beta	R^2	Period
NKF	Stable damped build-up	0.031	0.868	Negative period
Norit	Damped build-up	0.018	0.545	Negative period
Nutricia	Damped build-up	0.019	0.429	Negative period
Oce	Stable continous build-up	0.036	0.882	Neutral period
Ommeren	Stable continous build-up	0.122	0.925	Neutral period
Otra	Stable damped build-up	0.026	0.831	Negative period
P&C	Radical teardown	-0.020	0.124	Negative period
Pakhoed	Damped build-up	0.024	0.600	Negative period
Philips	Moderate continous build-up	0.041	0.645	Neutral period
Polygram	Stable continous build-up	0.052	0.910	Neutral period
Polynorm	Stable continous build-up	0.032	0.939	Neutral period
Rood	Moderate build-up	0.061	0.543	Positive period
Samas	Unstable damped teardown	-0.005	0.070	Positive period
Schuitema	Stable damped build-up	0.284	0.722	Negative period
Shell	Moderate continous build-up	0.101	0.431	Neutral period
Simac	Radical build-up	0.017	0.367	Positive period
Smit	Damped build-up	0.516	0.574	Negative period
Sphinx	Damped build-up	0.028	0.551	Negative period
Stork	Stable damped build-up	0.020	0.819	Negative period
Telegraaf	Damped build-up	0.021	0.587	Negative period
Tulip	Unstable continous teardown	-0.018	0.241	Neutral period
Twentsche	Stable continous build-up	0.044	0.951	Neutral period
Unilever	Stable continous build-up	0.044	0.723	Neutral period
VNU	Stable damped build-up	0.093	0.919	Negative period
Vredestein	Stable damped build-up	0.034	0.734	Negative period
Wegener	Stable continous build-up	0.045	0.980	Neutral period
Wolters	Stable damped build-up	0.070	0.948	Negative period

Concurreren met duale innovatie strategieën

een raamwerk ter analyse van de balans tussen operationele waardeschepping en de ontwikkeling van "resources"

Volgens het exploitatie - exploratie dilemma dient iedere onderneming een balans te vinden tussen operationele waardeschepping en de ontwikkeling van "resources". Het continu zoeken naar een balans is een belangrijk onderdeel van het proces van strategievorming. Het exploitatie - exploratie dilemma neemt in de hedendaagse management literatuur een belangrijke plaats in. Een instrument dat de balans tussen exploitatie en exploratie meet is thans nog niet aanwezig. Deze studie is een aanzet om de gedetecteerde lacune te dichten.

Ter analyse van het exploitatie - exploratie dilemma wordt gebruik gemaakt van het "punctuated equilibrium" paradigma. In dit paradigma is het mogelijk incrementele- en radicale innovaties, als respectievelijke determinanten van exploitatie en exploratie, te detecteren. Een gelijktijdige waarneming van exploitatie en exploratie is voor deze studie noodzakelijk, doch binnen het paradigma niet mogelijk. Als gevolg hiervan is het "punctuated equilibrium" paradigma aangepast.

Het aangepaste raamwerk combineert generieke bedrijfsprocessen en de "stakeholder" benadering zodat de oriëntatie en de inhoud van de verschillende onderlinge interacties analyseerbaar zijn. Het raamwerk is tevens gebaseerd op het dynamisch "resource" perspectief en contracttheorie. Het raamwerk legt de nadruk op interacties tussen de belangrijkste "stakeholders" alsmede tussen de bedrijfsprocessen.

In deze studie is verandering van reikwijdte en oriëntatie van het productieproces in relatie tot operationele waardeschepping gedefinieerd als incrementele innovatie. Een verandering in de ontwikkeling van "resources" in relatie tot visievorming is gedefinieerd als radicale innovatie. Optimalisering van het productieproces geschiedt binnen de huidige visie. Waardeketen-analyse wordt gehanteerd om stabiliteit of verandering van reikwijdte en oriëntatie van het productieproces in relatie tot operationele waardeschepping te detecteren. Exploratie is gedefinieerd als het opnieuw combineren van bestaande en het zoeken van nieuwe "resources".

Aan de hand van een kwalitatieve analyse is geconcludeerd dat een analyse van het exploitatie - exploratie dilemma door middel van generieke bedrijfsprocessen mogelijk is. Door exploitatie te koppelen aan het productieproces en exploratie aan het proces van "resource" vorming, zijn conclusies getrokken met betrekking tot stabiliteit en innovatie. Op deze wijze is het mogelijk ondernemingen binnen het exploitatie - exploratie dilemma te classificeren.

Een kwantitatief onderzoek is uitgevoerd ter validatie van het aangepaste raamwerk. Het empirisch onderzoek maakt gebruikt van gegevens van 85 Nederlandse ondernemingen, allen genoteerd op de Amsterdamse effectenbeurs, over een periode van gemiddeld 13 jaar. Uit het onderzoek blijkt dat 58% van de ondernemingen de oriëntatie van hun productieproces in relatie tot hun operationele waardeschepping hebben veranderd. Radicale innovatie bleek zeldzaam. Slechts 26% van de ondernemingen hebben de opbouw van hun "resources" veranderd.

De frequentie van incrementele innovatie is bijna twee keer zo hoog als de frequentie van radicale innovatie. Door de verandering in opbouw van "resources" te splitsen in een positieve en negatieve periode is geconcludeerd dat radicale innovatie duidelijk invloed heeft op de omvang van de operationele waardeschepping.

Additional statements to the dissertation
"Competing with dual innovation strategies"
by
Marc A. Zegveld

1. Success needs a perspective. The antecedents of this study, core stakeholder approach, generic firm processes and the planning horizon, each provides a different perspective. An integration of these perspectives is presented within the modified punctuated equilibrium paradigm. As a result of this integration 'success' is a complex and multi-dimensional construct.

2. Moment-specific scarcity of the different core stakeholders implies the end of organisation ideologies.

3. Implementation of innovation is a tautology.

4. Through innovation a company may prepare for tomorrow. However, innovation may also limit a company today.

5. Policies intended to stimulate incremental innovation may limit radical innovation and vice versa. In order to measure 'success' managers and regulators should specify their aims in terms of radical innovation or incremental innovation.

6. The Dutch expression "*Veel geschreeuw en weinig* ***WOL***" is applicable to both the development of exploration and exploitation of World-online N.V.

7. The use of metaphors (biological evolution) within management sciences is only worthwhile when a vocabulary and limitation of the conjunction are provided.

8. A clear definition of and coherent model on 'residual value' may increase the productivity of economics.

9. Companies are no textbook cases.

10. The request by youngsters to abandon the Dutch permissive society or "*gedoogbeleid*" is the signal that the sixties are finally over.

Competing

A framework to analyse the balance between operational value creation and the development of resources

Combining operational value creation and the development of resources is essential for businesses to become and remain successful. However many companies find it hard to balance these two types of activities. This study provides a framework to detect this dichotomy. Employing this framework, a quantitative model is developed to determine whether indeed a balance between exploitation and exploration can be found and how incremental and radical innovations should be positioned.

In this study exploitation is related to the organisation of the value chain. Exploration depends on the company's perspective. It is reasoned that radical innovation or the deployment of a different perspective result in a change of core stakeholders and hence in different combinations of core stakeholders.

The study concludes that a stable scope of the value chain prevails over incremental innovation when optimising exploitation. It is also concluded that after introducing radical innovation higher levels of cash flow are created. However, radical innovation is frequently combined with incremental innovation.

The developed framework and model provide the possibility to measure the actual and complex balance between exploitation and exploration of companies.

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TVA developments bv specialises in developing business strategies mainly for large Dutch companies. Marc Zegveld is specialised in the transformation of businesses from a function or product-orientation, to a flow or process-orientation. At TVA developments he has developed several methods and tools to facilitate such transformations successfully.

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